SIEMENS

syngo RT Therapist 4.1
DICOM Conformance Statement

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Print No. T11-000.640.06.03.02
Latest Update: 07/2011

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1. Introduction

1.1 Overview

The Conformance Statement describes the DICOM interface for the Siemens Oncology Products in terms of part 2 of [1].

This introduction describes the application's implemented DICOM functionality in general terms.

1.2 Scope and Field

The *syngo* RT product is a "*syngo*®-speaking" Imaging and planning modality or workstation. The *syngo* RT Workstations are designed to be integrated into an environment of medical DICOM-based devices. The *syngo* RT DICOM network implementation acts as SCU and SCP for the DICOM Storage, Storage Commitment and Query/Retrieve services and as SCU for the DICOM Print, DICOM Basic Worklist and Modality Performed Procedure Step Services. Verification is supported in SCU (only via Service environment) and SCP role. Furthermore the handling of [CD/MOD] offline media is supported as a FSC, FSU and FSR.

This DICOM Conformance Statement refers to SIEMENS *syngo* RT Therapist 4.1 using *syngo* software. The following table relates the product name to the SIEMENS product:

Software Name	SIEMENS syngo-based Product
Therapist 4.1	syngo RT Therapist 4.1 syngo RT Therapist 4.1 Assist syngo RT Therapist 4.1 Express syngo RT Therapist 4.1 Express Assist

1.3 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

1.4 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality as SCU and SCP, respectively.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with Siemens and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 Standard [1]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

1. The comparison of different conformance statements is the first step towards assessing interconnectivity between Siemens and non-Siemens equipment.
2. Test procedures should be defined and tests should be performed by the user to validate the connectivity desired. DICOM itself and the conformance parts do not specify this.
3. The standard will evolve to meet the users' future requirements. Siemens is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.
4. Siemens reserves the right to modify the design and specifications contained herein without prior notice. Please contact your local Siemens representative for the most recent product information.

1.5 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Additional Abbreviations and terms are as follows:

ACR	American College of Radiology
AE	Application Entity
ASCII	American Standard Code for Information Interchange
CSE	Customer Service Engineer
DB	Database
DCS	DICOM Conformance Statement
DSA	Digital Subtraction Angiography
IIDC	Image-Intensifier Distortion Correction
IOD	Information Object Definition
ISO	International Standard Organization
NEMA	National Electrical Manufacturers Association

Optional Key Attribute

PDU	Protocol Data Unit
R	Required Key Attribute
RIS	Radiology Information System
RWA	Real-World Activity
SCU	Service Class User (DICOM client)
SCP	Service Class Provider (DICOM server)
SOP	Service-Object Pair
U	Unique Key Attribute

1.6 References

[1] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.15, 2003. National Electrical Manufacturers Association (NEMA). The DICOM Standard is under continuous maintenance, the current official version is available at http://dicom.nema.org.

1.7 Structure

This Conformance Statement is subdivided into multiple Parts, which relate to individual documents needed to declare Conformance according to the requirements of “Part 2 - Conformance” of the DICOM Standard.

Those parts are:

- “Network Conformance Statement” for Network related Services
  - Storage - User/Provider (includes Verification - User/Provider)
  - Storage Commitment – User/Provider
  - Query/Retrieve – User/Provider
  - Basic Grayscale/Color Print – User
  - Basic Worklist – User
  - Modality Performed Procedure Step – User
- A privately defined “Media Conformance Statement”
- and the “Offline Media Conformance Statement” to support local archive media.
- A general Appendix.

2. Implementation Model Verification

The *syngo* RT DICOM Service application requests Verification to verify the ability of a foreign DICOM application on a remote node to respond to DICOM messages.

Responding to Verification requests from remote nodes is handled by the Storage SCP application.

2.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU for the C-ECHO DICOM network service.

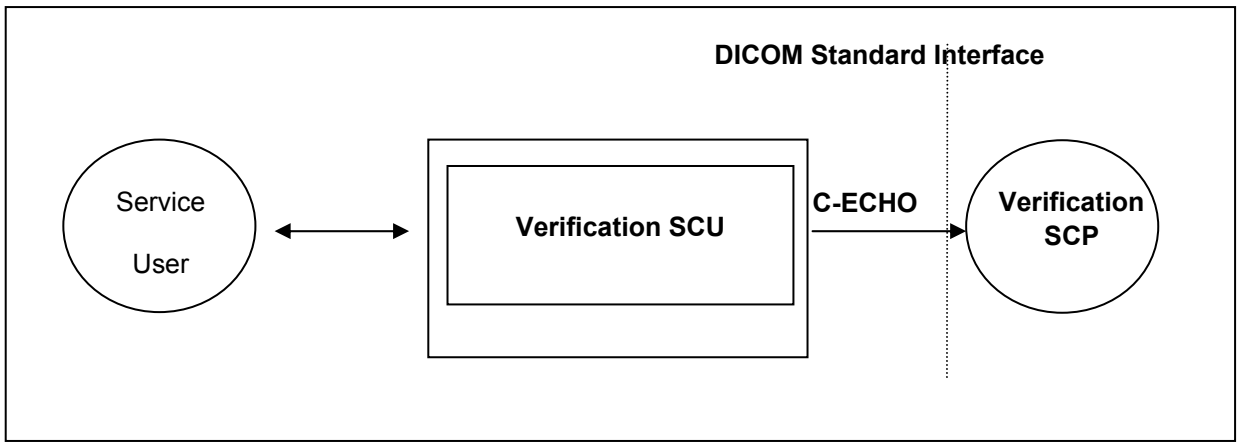


Figure 1: Application Data Flow Diagram - Verification SCU

2.2 Functional Definitions of Applications

The *syngo* RT DICOM Service application opens an association when a “verification” of a remote application is requested during a configuration session. This can be done when entering new data for remote application configuration or to verify existing configuration data.

2.3 Sequencing of Real-World Activities

Newly entered data have to be saved first, before a “verification” of these data is possible.

3. Application Entity Specification Verification

3.1 Verification AE Specification

3.1.1 Association Establishment Policies

3.1.1.1 General

The *syngo* RT DICOM Service application attempts to open an association for verification request whenever the “verification” function is activated during network configuration of a remote DICOM application.

3.1.1.2 Number of Associations

The *syngo* RT DICOM Service application initiates one association at a time to request verification.

3.1.1.3 Asynchronous Nature

The *syngo* RT DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

3.1.1.4 Implementation Identifying Information

***syngo* Suite for Oncology product**	**Implementation Class UID**	**Implementation Version Name**
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

3.1.2 Association Initiation Policy

The *syngo* RT DICOM Service application attempts to initiate a new association for

- DIMSE C-ECHO service operations.

3.1.2.1 Associated Real-World Activity - Verification

3.1.2.1.1 Associated Real-World Activity – Request Verification “verification”

The associated Real-World activity is a C-ECHO request, initiated by Service and Configuration SW environment whenever a “verification” is requested. If an association to a remote Application Entity is successfully established, Verification with the configured AET is requested via the open association. If the C-ECHO Response from the remote Application contains a status other than “Success” this will be indicated in the service environment and the association is closed.

3.1.2.1.2 Proposed Presentation Contexts

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table – Verification SCU					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1	SCU	None

3.1.2.1.3 SOP Specific Conformance – Verification SCU

The Application conforms to the definitions of the Verification SCU in accordance to the DICOM Standard.

3.1.3 Association Acceptance Policy

The Verification SCP is part of the Storage SCP – see section 5.1.3.

4. Implementation Model Storage

The *syngo* RT DICOM Application Entity both originates associations for Storage of DICOM Composite Information Objects in Remote Application Entities and accepts association requests for Storage from Remote Application Entities.

4.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU and SCP for the C-STORE DICOM network service and as SCP for the C-ECHO DICOM network service.

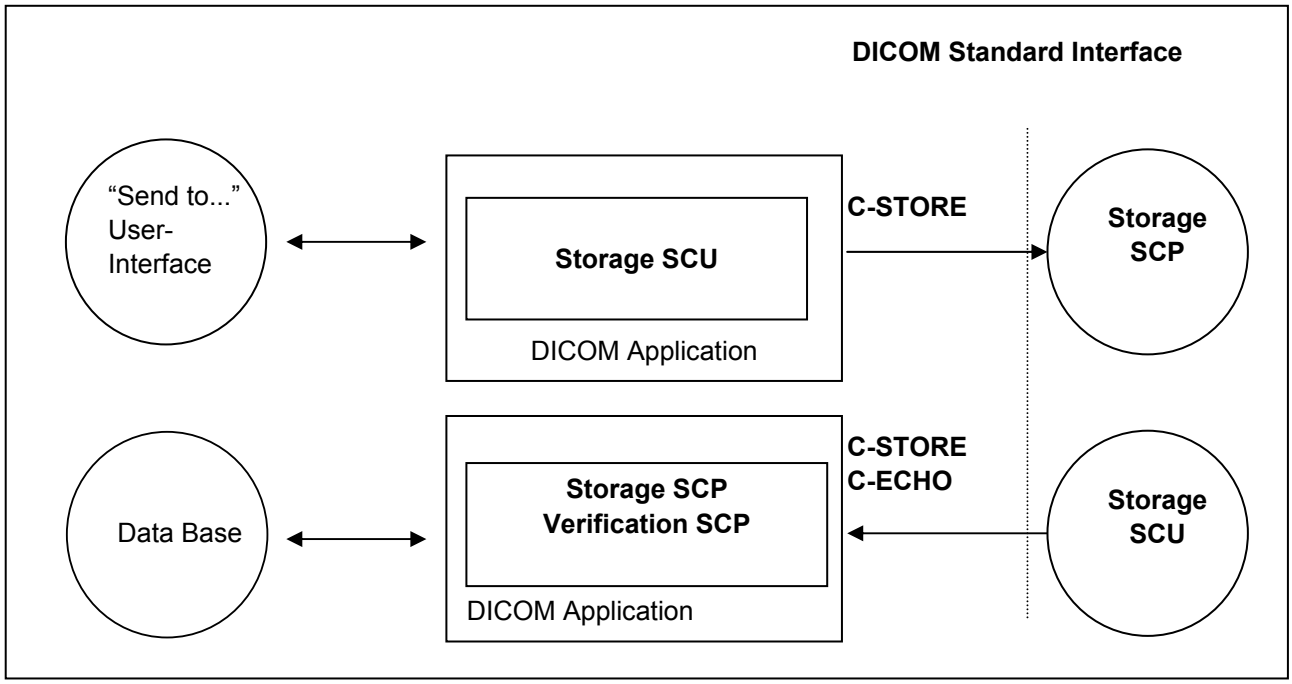


Figure 2: Application Data Flow Diagram – Storage SCU/SCP

4.2 Functional Definitions of Application Entities

The Storage SCU is invoked by the job control interface that is responsible for processing network archival tasks. The job consists of data describing the Composite Information Objects selected for storage and the destination. An association is negotiated with the destination application entity and the image data is transferred using the C-STORE DIMSE-Service. Status of the transfer is reported to the job control interface.

The Storage SCP component of the *syngo* RT DICOM application is operating as background server process. It is existing when the machine is powered on and waits for Storage association requests. Upon accepting an association with a negotiated Presentation Context it starts to receive the Composite Information Objects and imports them to local database. Verification requests will be processed and responded by Storage SCP component too.

4.3 Sequencing of Real-World Activities

Not applicable.

5. Application Entity Specification Storage

5.1 Storage AEs Specification

The *syngo* RT Storage service class user/service class provider applications use one AE when initiating/receiving associations to/from remote DICOM nodes.

SIEMENS DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital MammoGraphy Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital MammoGraphy Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Intra-oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3.1
Digital Intra-oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
RadioTherapy Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RadioTherapy Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RadioTherapy Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RadioTherapy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
UltraSound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
UltraSound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray RadioFluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1

SIEMENS DICOM products provide Private Conformance to the following DICOM V3.0 conform private SOP Classes as an SCU:

SOP Class Name	SOP Class UID
CSA Non-Image Storage	1.3.12.2.1107.5.9.1

SIEMENS DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as an SCP:

SOP Class Name	SOP Class UID
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Computed Tomography Image Storage	1.2.840.10008.5.1.4.1.1.2
Digital X-Ray Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital MammoGraphy Image Storage – for Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital MammoGraphy Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Intra-oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3.1
Digital Intra-oral X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.3
Magnetic Resonance Image Storage	1.2.840.10008.5.1.4.1.1.4
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
PET Image Storage	1.2.840.10008.5.1.4.1.1.128
RadioTherapy Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RadioTherapy Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RadioTherapy Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RadioTherapy Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
UltraSound Multi-Frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3
UltraSound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
UltraSound Image Storage	1.2.840.10008.5.1.4.1.1.6.1
UltraSound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray RadioFluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1

SOP Class Name	SOP Class UID
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1
Verification	1.2.840.10008.1.1

SIEMENS DICOM products provide Private Conformance to the following DICOM V3.0 conform private SOP Classes as an SCP:

SOP Class Name	SOP Class UID
CSA Non-Image Storage	1.3.12.2.1107.5.9.1

5.1.1 Association Establishment Policies

5.1.1.1 General

The existence of a job queue entry with network destination or an internal trigger from processing a retrieve request will activate the DICOM Storage Application. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the transfer is started.

The default PDU size used will be 28 KB.

5.1.1.2 Number of Associations

The *syngo* RT DICOM application initiates several associations at a time, one for each destination to which a transfer request is being processed in the active job queue list.

The *syngo* RT DICOM application is able to accept multiple associations at a time. It can handle up to 10 associations in parallel.

The number of Simultaneous DICOM associations can be configured via the Service-UI. The dialog can be found in Configuration / DICOM / General.

5.1.1.3 Asynchronous Nature

The *syngo* RT DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

5.1.1.4 Implementation Identifying Information

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

5.1.2 Association Initiation Policy

If a job with network destination gets active in the job list or a retrieve sub-operation is processed the *syngo* RT DICOM application attempts to initiate a new association for

- DIMSE C-STORE

service operations.

5.1.2.1 Associated Real-World Activity - Send

5.1.2.1.1 Associated Real-World Activity – Send Information Objects to a Network Destination

The associated Real-World activity is a C-STORE request initiated by an internal daemon process triggered by a job with network destination or the processing of an external C-MOVE retrieve request. If the process successfully establishes an association to a remote Application Entity, it will transfer each object one after another via the open association. If the C-STORE Response from the remote Application contains a status other than “Success” or “Warning”, the association is aborted.

5.1.2.1.2 Proposed Presentation Context – Send Information Objects

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Computed Tomography Image	1.2.840.10008.5.1.4.1.1.2	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Digital X-Ray Image for processing	1.2.840.10008.5.1.4.1.1.1.1.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Digital X-Ray Image for presentation	1.2.840.10008.5.1.4.1.1.1.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
MammoGraphy Image for processing	1.2.840.10008.5.1.4.1.1.1.2.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
MammoGraphy Image for presentation	1.2.840.10008.5.1.4.1.1.1.2	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Digital Intra-oral X-Ray Image for processing	1.2.840.10008.5.1.4.1.1.1.3.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Digital Intra-oral X-Ray Image for presentation	1.2.840.10008.5.1.4.1.1.1.3	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Magnetic Resonance Image	1.2.840.10008.5.1.4.1.1.4	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
PET Image	1.2.840.10008.5.1.4.1.1.128	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
		Implicit VR Little Endian	1.2.840.10008.1.2		
RT Image	1.2.840.10008.5.1.4.1.1.481.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultra-Sound Multi-Frame Image	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Ultra-Sound Image	1.2.840.10008.5.1.4.1.1.6.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
X-Ray RadioFluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	JPEG Lossy Extended *1 (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) *1 Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Waveform	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Waveform 12-Lead ECG Object	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Waveform General ECG Object	1.2.840.10008.5.1.4.1.1.9.1.2	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Waveform Ambulatory ECG Object	1.2.840.10008.5.1.4.1.1.9.1.3	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Waveform Hemodynamic Object	1.2.840.10008.5.1.4.1.1.9.2.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Waveform Cardiac Electro-physiology Object	1.2.840.10008.5.1.4.1.1.9.3.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Waveform Basic Audio Object	1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
CSA Non-Image	1.3.12.2.1107.5.9.1	Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1	SCU	None

***1:** The Transfer Syntax used is strongly influenced by the fact of “how was the accepted Transfer Syntax at the time when the Instance was received”. E.g. the Instances received with JPEG Lossy Transfer Syntaxes will not be converted and can only be sent out with the same Transfer Syntax.

Note: The proposed Transfer Syntax is highly restricted for images stored internally in lossy compressed format. E.g. instances received with JPEG Loss Transfer Syntaxes will not be converted and can only be sent out with the same Transfer Syntax.

The “MOVE destinations” must be configured as Storage destinations. This would include the configuration of Transfer Syntax capabilities.

Not all the listed transfer syntaxes will be proposed all the time. For some abstract syntaxes only a list of uncompressed (UC) transfer syntaxes (one or more) will be proposed, for other abstract syntaxes also JPEG Loss less (LL) syntax will be proposed and/or a list of JPEG Lossy (LY) transfer syntaxes. The contents of this lists is configurable, e.g. UC could be configured to contain only Implicit Little Endian for instance.

Depending on the real world activity initiating the C-STORE, we have the following behaviors:

- If the C-STORE is initiated by a user, a configuration parameter called Quality Factor (Q) will be used to decide which transfer syntax lists will be proposed. Q can take values between 0 and 100. If Q=0, only UC will be proposed. If Q = 100, UC and LL will be proposed. Else UC and LY will be proposed.
- If the C-STORE is initiated by the C-MOVE SCP, there is another configuration parameter called Compression Types Supported (CTS) which will be used to decide what transfer syntaxes are proposed. CTS can take integer values. If CTS=0 or CTS > 3, UC will be proposed. If CTS=1, UC and LY will be proposed. If CTS = 2, UC and LL will be proposed. If CTS >= 3, UC, LL and LY will be proposed.

The compression types JPEG lossy and JPEG loss less are parameters, which are part of the Application Entity Properties configuration (storage checked). It can by reached via the Service-UI: Configuration / DICOM / Network nodes

5.1.2.1.3 SOP Specific Conformance to Storage SOP Classes

The *syngo* RT DICOM application will create SC IOD type images when performing special applications that create Derived Images. The SC IOD will be a Standard Extended SC Storage SOP Class. The 3D viewing application is able to create further 2D (SC) images to document results from 3D processing.

The *syngo* RT DICOM application will not change private attributes as long as no modification is done. During a “Save as ...” operation all private attributes not defined within the *syngo* RT DICOM application will be removed when the new object instance is created.

For association and DIMSE level time-outs, please refer to Configuration section of this document.

5.1.2.1.3.1 Optional Attributes

Data Dictionary of DICOM Type 2 and 3 IOD Attributes

Please see the related Information Object definition tables in the Annex for a list of all DICOM IOD attributes of type 2 and 3, which are encoded by the *syngo* RT DICOM application.

5.1.2.1.3.2 Specialized Information Object Definitions

The DICOM objects created by *syngo* RT DICOM application conform to the DICOM IOD definitions (Standard extended IODs). But they will contain additional private elements, which have to be discarded by a DICOM system when modifying the object.

The DICOM nodes are responsible for data consistency when modifying objects. All unknown private attributes have to be removed upon modification!

Data Dictionary of applied private IOD Attributes

Please see “A.2” in the Annex for a list of possible private IOD attributes

5.1.3 Association Acceptance Policy

The *syngo* RT DICOM application attempts to accept a new association for

- DIMSE C-ECHO
- DIMSE C-STORE

service operations. Any Information Objects transmitted on that association will be checked on conformance and stored in database if check was successful.

5.1.3.1 Associated Real-World Activity - Receive

5.1.3.1.1 Associated Real-World Activity – Receiving Objects from a Remote Node

The daemon receiving process will accept an association and will receive any images transmitted on that association and will store the objects on disk in the own database if the conformance check is performed successfully.

5.1.3.1.2 Accepted Presentation Context – Receiving Objects

The *syngo* RT DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Computed Radiography Image	1.2.840.10008.5.1.4.1.1.1	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Computed Tomography Image	1.2.840.10008.5.1.4.1.1.2	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Digital X-Ray Image	1.2.840.10008.5.1.4.1.1.1.1.1 1.2.840.10008.5.1.4.1.1.1.1	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
MammoGraphy Image	1.2.840.10008.5.1.4.1.1.1.2.1 1.2.840.10008.5.1.4.1.1.1.2	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Digital Intra-oral X-Ray Image	1.2.840.10008.5.1.4.1.1.1.3.1 1.2.840.10008.5.1.4.1.1.1.3	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Magnetic Resonance Image	1.2.840.10008.5.1.4.1.1.4	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Nuclear Medicine Image	1.2.840.10008.5.1.4.1.1.20	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
PET Image	1.2.840.10008.5.1.4.1.1.128	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
RT Image	1.2.840.10008.5.1.4.1.1.481.1	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Ultra-Sound Multi-Frame Image (retired) *1	1.2.840.10008.5.1.4.1.1.3	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
		Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.2 1.2.840.10008.1.2		
Ultra-Sound Image (retired) *1	1.2.840.10008.5.1.4.1.1.6	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Ultra-Sound Multi-Frame Image	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Ultra-Sound Image	1.2.840.10008.5.1.4.1.1.6.1	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
X-Ray RadioFluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	JPEG Lossy Extended (Process 2 & 4) JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
Waveform	1.2.840.10008.5.1.4.1.1.9.1.1 1.2.840.10008.5.1.4.1.1.9.1.2 1.2.840.10008.5.1.4.1.1.9.1.3 1.2.840.10008.5.1.4.1.1.9.2.1 1.2.840.10008.5.1.4.1.1.9.3.1 1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Little Endian Explicit VR Big Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCP	None
CSA Non-Image Storage	1.3.12.2.1107.5.9.1	Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1	SCP	None

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Big Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.2 1.2.840.10008.1.2.1	SCP	None

***1)** US Retired and US Multi-frame Retired images are converted to US Images/US Multi-frame images before storing them into the local database. The conversion creates new images, which implies new UIDs.

Note: With RLE Lossless Transfer Syntax the DICOM application will decompress the image before storing it into the database.

5.1.3.1.3 SOP-specific Conformance Statement – Receiving Objects

The *syngo* RT DICOM application conforms to the Full Storage Class at Level **2**.

Upon successful receiving a C-STORE-RQ, the Siemens *syngo* RT DICOM receiver performs a quick plausibility test on the received object and available system resources. If this test succeeds, it returns the status SUCCESS , otherwise one of the following status codes is returned and the association is aborted:

Refused (A700):
This error status indicates a lack of Resources (e.g. not enough disk space) on the *syngo* RT modality.

Invalid Dataset (0xA900):
The dataset is not containing one of the Attributes “Study Instance UID”, “Series Instance UID” or “SOP Instance UID”, or one of them has an invalid value.

Processing Error (0110):
An error occurred while processing the object, which makes it impossible to proceed

Attention! Only after sending the response, the object will be saved into the database. If during this operation an error occurs, the association will be aborted. This implies that a C-STORE-RSP with status SUCCESS does not mean that the image was successfully stored into the database.

In order to confirm that the sent images where successfully stored in the database, the sending application should use Storage Commitment Service.

If an object instance is received that is identified by a SOP Instance UID which is already used by an Instance stored in database then the actual received object will be discarded. The existing Instance is not superseded.

The following sections will differentiate the attribute contents required for Image Viewing. The *syngo* RT DICOM application supports more formats for Storage of Images than Viewing.

5.1.3.1.3.1 Image Pixel Attribute Acceptance Criterion for Grayscale Images - Viewing

The *syngo* RT Multi-Modality Viewing application accepts the MONOCHROME1 and MONOCHROME2 photometric interpretation pixel format and graphic overlay with unsigned integer and 8 or 16 bits allocated. Accepted values:

- Pixel plane
  - samples per pixel (attribute 0028, 0002) = 1
  - photometric interpretation (attribute 0028,0004) = “MONOCHROME1”
  - photometric interpretation (attribute 0028,0004) = “MONOCHROME2”
  - pixel representation (attribute 0028, 0103) = 0
  - bits allocated (attribute 0028, 0100) = 8, 16
  - bits stored (attribute 0028,0101) = 8, 10, 12
  - high bit (attribute 0028,0102) = 7, 9, 11
  - only aspect ratio 1:1 is supported

- Overlay plane
  - overlay type (attribute 60xx, 0040) = “G”
  - bits allocated (attribute 60xx, 0100) = 16
  - bit position (attribute 60xx, 0102) = 12, 13, 14, 15 (only bits above high bit permitted)
  - Graphic Overlay will be shifted to fill Overlay Planes from Bit 12 and consecutive.
- Overlay plane
  - overlay type (attribute 60xx, 0040) = “G”
  - bits allocated (attribute 60xx, 0100) = 1
  - bit position (attribute 60xx, 0102) = 0
  - overlay data (attribute 60xx, 3000) = supported

The *syngo* RT Multi-Modality Viewing application accepts also the MONOCHROME1 and MONOCHROME2 photometric interpretation pixel format with binary 2’s complement integer and 16 bits allocated. Accepted values:

- Pixel plane
  - samples per pixel (attribute 0028, 0002) = 1
  - photometric interpretation (attribute 0028,0004) = “MONOCHROME1”
  - photometric interpretation (attribute 0028,0004) = “MONOCHROME2”
  - pixel representation (attribute 0028, 0103) = 1 (signed)
  - bits allocated (attribute 0028, 0100) = 16
  - bits stored (attribute 0028,0101) = 16
  - high bit (attribute 0028,0102) = 15
  - only aspect ratio 1:1 is supported
- Overlay plane
  - overlay type (attribute 60xx, 0040) = “G”
  - bits allocated (attribute 60xx, 0100) = 1
  - bit position (attribute 60xx, 0102) = 0
  - overlay data (attribute 60xx, 3000) = supported
  - For MOD LUT, both the linear LUT (Rescale Slope/Intercept) and the MOD LUT SQ are supported and considered when pixel data is displayed. However there are two limitations. The MOD LUT SQ will be ignored in the following cases:
- 8-Bit signed pixels
- the pixel format is changed by the MOD LUT (e.g. 8bit -> 16bit)

If the MOD LUT SQ contains multiple LUTs, then only the first one is used.

For VOI LUT, both the linear LUT (Window Center/Width) and the VOI LUT SQ are supported (VOI LUT SQ with 8 or 16 bit LUT data)

But if both, a VOI LUT SQ and a linear MOD LUT, are specified within one image, then the value for Rescale Slope is restricted to 1.

If the VOI LUT SQ contains multiple LUTs, then only the first one is used by default. The other VOI LUTs are selectable.

Only Rectangular and Circular Shutter Shape is supported in this version. Images containing other Shutter Shapes will be displayed w/o shutter.

5.1.3.1.3.2 Image Pixel Attribute Acceptance Criterion for Color Images - Viewing

The *syngo* RT Multi-Modality Viewing application supports the RGB color image description with the unsigned integer 24-bit color image plane pixel format. Accepted values:

- samples per pixel (attribute 0028, 0002) = 3
- photometric interpretation (attribute 0028,0004) = “RGB”
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8
- bits stored (attribute 0028,0101) = 8
- high bit (attribute 0028,0102) = 7
- planar configuration (attribute 0028,0006) = 0 (pixel interleave) or 1 (plane interleave).

The *syngo* RT Multi-Modality Viewing application supports the “Palette Color” color image description with the unsigned integer and 2’s complement pixel format. Accepted values:

- samples per pixel (attribute 0028, 0002) = 1
- photometric interpretation (attribute 0028,0004) = “PALETTE COLOR”
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8 and bits stored (attribute 0028,0101) = 8
- bits allocated (attribute 0028, 0100) = 16 and bits stored (attribute 0028,0101) = 16
- high bit (attribute 0028,0102) = 7, 15

Both 8-bit and 16-bit palettes are supported, but NO Segmented Palette Color LUTs.

The *syngo* RT Multi-Modality Viewing application supports the YBR_FULL color image description with the unsigned integer pixel format. Accepted values:

- samples per pixel (attribute 0028, 0002) = 3
- photometric interpretation (attribute 0028,0004) = “YBR_FULL”
- pixel representation (attribute 0028, 0103) = 0
- bits allocated (attribute 0028, 0100) = 8 and bits stored (attribute 0028,0101) = 8
- high bit (attribute 0028,0102) = 7

If *syngo* RT DICOM application is making any persistent changes on a YBR image, the resulting new image will be saved with Photometric Interpretation = “RGB”.

5.1.3.1.4 Presentation Context Acceptance Criterion

The *syngo* RT DICOM application will accept any number of verification or storage SOP classes that are listed above. The number of presentation contexts accepted is limited to the maximum of 127 (DICOM limit). In the event that the *syngo* RT DICOM application runs out of resources, it will reject the association request.

5.1.3.1.5 Transfer Syntax Selection Policies

The *syngo* RT DICOM application currently supports

- the Implicit VR Little Endian, the Explicit VR Little Endian and Explicit VR Big Endian Transfer Syntaxes
- the JPEG Lossless Non-hierarchical Transfer Syntax
- the JPEG Baseline and JPEG Extended Transfer Syntaxes (JPEG Lossy).
- the RLE Lossless Transfer Syntax

Any proposed presentation context including one of these Transfer Syntaxes will be accepted. Any proposed presentation context that does not include one of these Transfer Syntaxes will be rejected.

The order of preference in accepting Transfer Syntaxes within Presentation Contexts or Presentation Contexts with single Transfer Syntaxes is:

- JPEG Lossy Extended
- JPEG Lossless non-hierarchical
- JPEG Lossy Baseline
- RLE Lossless
- Explicit VR Little Endian
- Explicit VR Big Endian
- Implicit VR Little Endian

With RLE Lossless Transfer Syntax the *syngo* RT DICOM application will decompress the object before storing it into the database.

With Implicit VR Little Endian Transfer Syntax the *syngo* RT DICOM application will remove any Private Attributes not known to the application. Decision on removal of a Private Element is done if there is NO entry in the attribute-dictionary of the *syngo* RT DICOM application.

Therefore any Explicit VR Transfer Syntax shall preferably be used by the Storage SCU's when sending Composite Object Instances to the *syngo* RT DICOM application.

6. Implementation Model Storage Commitment

The Storage Commitment service class defines an application-level class of service which facilitates the commitment to storage. It performs an additional task of commitment of composite objects apart from the network based storage of objects as defined by the Storage Service class. The *syngo* RT DICOM implementation supports the Storage Commitment Push Model as SCU and SCP.

6.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU/SCP for the Storage Commitment Push Model Service using the Storage Commitment Service Class.

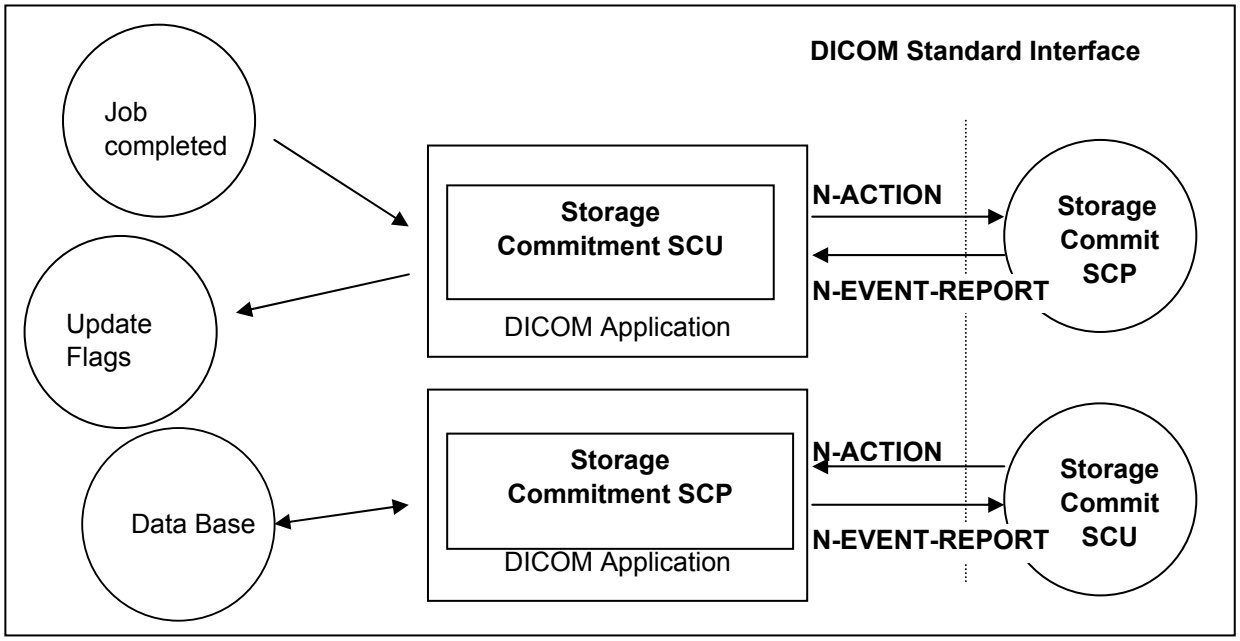


Figure 3: Application Data Flow Diagram – Storage Commitment SCU/SCP

6.2 Functional Definitions of Application Entities

With each successfully completed send job, the *syngo* RT DICOM application will create a Storage Commitment Push Model Identifier from the SOP Instances sent. Then a Storage Commit Request is triggered. Depending on configuration, the *syngo* RT DICOM application will keep the association open for responses with a configurable time-out, or closes the association and expects responses on a different association that has to be establishes by the remote Storage Commitment SCP.

The commitment status derived from the related trigger response will be indicated in the related Status Flags of the related entity. It is possible to create triggers (“auto rules”) from this event.

The Transaction UIDs of the pending commitment request are kept “open” for a configurable amount in time (default: 1h). If the “open time” for a pending commitment request has elapsed w/o a related response from the provider, the Transaction UID is removed and the related entities are indicated as “commit failed”.

In any case, commitment will only be requested for previously and successfully sent objects.

The Storage Commitment SCP is running in background and is ready to receive request when the system is started.

6.3 Sequencing of real World Activities

The Storage Commitment trigger is automatically derived from the successful completion of a Send Job.

7. Application Entity Specification Storage Commitment

7.1 Storage Commitment AE Specification

SIEMENS *syngo* RT DICOM application provides Standard Conformance to the following DICOM V3.0 SOP Class as an SCU and SCP:

SOP Class Name	SOP Class UID
Storage Commitment Push Model	1.2.840.10008.1.20.1

7.1.1 Association Establishment Policies

7.1.1.1 General

With a Send Job successfully completed, the DICOM application will generate an Storage Commitment Identifier which references to all Instances of the processed job. The Commit Request is then sent over a single opened association. The *syngo* RT application will wait for Status responses of the Storage Commitment Request. If the Provider accepts the Storage Commitment with Success Status, the generated Transaction UID, together with study identification data and a time-stamp, is kept. Depending on configuration, the association is closed when the configured time-out has elapsed or a response was received before. If the association is closed before a response was received, the response is then expected on a different association. Multiple Storage Commitment Requests can be pending.

The default PDU size used will be 28 KB.

7.1.1.2 Number of Associations

The *syngo* RT DICOM application initiates several associations at a time, one for each destination to which a transfer request is being processed in the active job queue list.

The *syngo* RT DICOM application is able to accept multiple associations at a time. It can handle up to 10 associations in parallel.

7.1.1.3 Asynchronous Nature

The *syngo* RT DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

7.1.1.4 Implementation Identifying Information

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

7.1.2 Association Initiation Policy

The *syngo* RT DICOM Application Entity acts as a Service Class User (SCU) for the Storage Commitment Push Model Service Class (to request commitment for storage of instances previously sent).

To do so, the *syngo* RT application will issue an

- N-ACTION DIMSE to request commitment or a
- N-EVENT-REPORT DIMSE to respond to a received storage commitment request and the association was closed by the remote system prior to response.

7.1.2.1 Real World Activity – Storage Commitment

7.1.2.1.1 Associated Real-World Activity - Job Completed

The *syngo* RT Storage Commitment application sends the commit request (N-ACTION-RQ) message and waits for acceptance of this request (N-ACTION-RSP). After receiving this, the transaction is marked as “waiting”.

Depending on a configuration value, the association will then be closed or kept open. In the first case, there is another configurable timeout giving the number of hours (h) and minutes (m) (by default 1h:0m) to wait for the corresponding commit response (N-EVENT-REPORT). In the second case, this time is the (also configurable) time-out for the association. For both cases, if the commit response (N-EVENT-REPORT) does not arrive during the configured time, the transaction will be marked as failed. The *syngo* RT DICOM application does not re-send objects from a failed Storage Commitment result in any case.

If the commit response (N-EVENT-REPORT) received has the status of “complete - failure exists”, the transaction is marked as failed, else the transaction is marked as “completed”; In both cases, a message is shown to the user.

7.1.2.1.2 Proposed Presentation Contexts - Job Completed

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

7.1.2.1.3 SOP Specific Conformance Statement - Job Completed

Storage Commitment is supported for all the SOP class UIDs as mentioned in ’Acceptable presentation contexts - Storage’ in the Storage SCP section of this document.

The Referenced Study Component Sequence is not supported.

Storage Media File-Set ID and UID Attributes will not be supported in the commitment request (N-ACTION primitive) invoked by the Storage Commitment SCU.

7.1.2.1.4 Associated Real-World Activity - Send Commit Response

Acting as a Storage Commitment Provider, the *syngo* RT Storage Commitment Application Entity received a Storage Commitment request, carried out the request, and is ready to send back the response, but the association is not open anymore. In this case it will by itself initiate an association to send the storage commitment response (N-EVENT-REPORT) to the SCU.

7.1.2.1.5 Proposed Presentation Contexts - Send Commitment Response

The Siemens *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

7.1.2.1.6 SOP Specific Conformance Statement - Send Commitment Response

Storage Media File-Set ID and UID Attributes will not be supported in the N-EVENT-REPORT primitive invoked by the Storage Commitment SCP.

7.1.3 Association Acceptance Policy

The *syngo* RT DICOM Application Entity acts as a Service Class Provider (SCP) for the Storage Commitment Push Model Service Class (Give a commitment to store previously received instances).

To do so, the *syngo* RT application attempts to accept an

- N-ACTION DIMSE to receive a commitment request for the instance included or a
- N-EVENT-REPORT DIMSE to receive a storage commitment response from a previous request

and the SCP behavior requires a different association than the commit request.

7.1.3.1 Associated Real-World Activity - Commit SCP

7.1.3.1.1 Associated Real-World Activity - Receive Commit Request

When receiving an Storage Commitment request the *syngo* RT DICOM application will perform the necessary steps to check the received list Instances against the local database or, if configured, check the Instances with the attached archive system.>

7.1.3.1.2 Accepted Presentation Contexts - Receive Commit Request

The Siemens *syngo* RT DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

7.1.3.1.3 SOP-specific Conformance Statement - Receive Commit Request

The *syngo* RT Storage Commitment DICOM Application Entity can be configured to run on an archive system.

If the Storage Commitment Application is running on an archive system, it will interact with this archive system in order to commit the storage of images and will send back to the SCU the result of the operation.

If not running on an archive node, the *syngo* RT Storage Commitment Application Entity will return success for images that are stored in the local database and failure for images that are not. However, the committed images can later be deleted by the user on the SCP side!

Remark: When not running on an archive system, sending data with Storage Commitment via network is a safe data transfer but does not fulfill the regulatory requirements of long-term archiving, objects with the "committed" flag may be deleted by the user.

7.1.3.2 Associated Real-World Activity - Commit SCU

7.1.3.2.1 Associated Real-World Activity - Update Flags

The *syngo* RT Storage Commitment DICOM Application Entity has sent a Storage Commitment Request and, being configured to receive response on a separate association, has closed the association, and now it gets an association request from the Storage Commitment SCP that want to send the results. The

syngo RT DICOM application will wait for Storage Commitment Notification triggering. Any incoming Notification will be checked for validity, that is, if the related Transaction UID is still part of the Pending Request Queue.

If the Notification is valid, the Notification Identifier is evaluated and the related Instances marked with the related status. The over-all Commit Status of the higher Information Entities is derived from propagation of the States of all Image entities included in a study.

The Status Flags directly affected by Storage Commitment results and indicated in the different entities of the Patient Browser list can be one of

- "AC" or "SC" - Successful Commitment, A means archived to configured Archive destination, whereas S means sent to any other destination
- "Af" of "Sf" - Commitment failed.
- "A?" or "S?" - Commitment request is sent, response is pending.

In case of failure the user has to repeat the transfer of images to the Archive destination. Another Storage Commitment will be performed after sending is completed successfully.

7.1.3.2.2 Accepted Presentation Contexts - Update Flags

The *syngo* RT DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

7.1.3.2.3 SOP-specific Conformance Statement - Update Flags

If the Commitment response (N-EVENT-REPORT) received has the status of "complete - failure exists", the transaction is marked as failed, otherwise the transaction is marked as "completed". In both cases, a message is shown to the user.
The related status flags are set for the committed images in the local database.

Note: The *syngo* RT DICOM application will NOT support the Storage Media File Set ID attributes.

8. Implementation Model Query/Retrieve

The Query/Retrieve service class defines an application-level class of services which facilitates the management of objects and patient data against the well-defined information model of DICOM and allows a DICOM AE to retrieve objects from a remote DICOM node or to request a remote DICOM AE to initiate a transfer of objects to another DICOM AE. The *syngo* RT DICOM Query/Retrieve application supports the Query/Retrieve services to act as SCU and SCP.

8.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU and SCP for the Query/Retrieve network service.

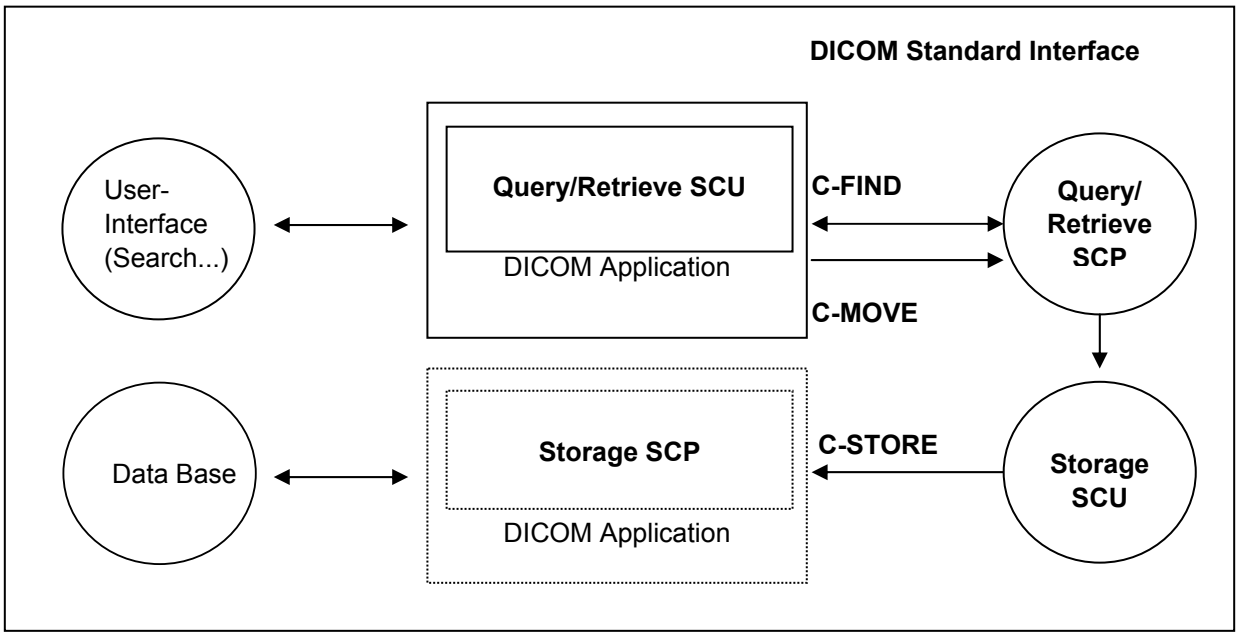


Figure 4: syngo RT Application Data Flow Diagram – Query/Retrieve SCU

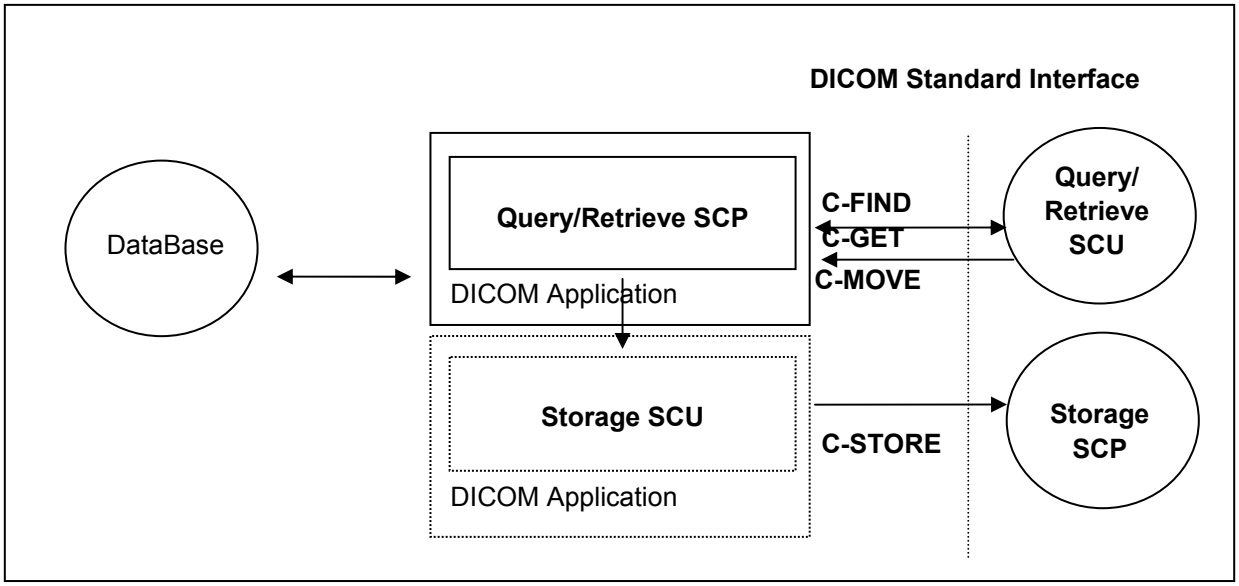


Figure 5: syngo RT Application Data Flow Diagram – Query/Retrieve SCP

8.2 Functional Definitions of Application Entities

The *syngo* RT DICOM Query/Retrieve SCU requests the remote Query/Retrieve SCP to perform a search and match to the keys specified in the request in order to display the results in the *syngo* RT user interface. Depending on user action (Import) the *syngo* RT DICOM SCU sends a C-MOVE DIMSE service to initiate a C-STORE sub-operation on the SCP to start an object transfer from remote Storage SCU (running on Query/Retrieve SCP) to the *syngo* RT Storage SCP.

The *syngo* RT DICOM Query/Retrieve SCP responds to C-FIND DIMSE services from remote SCU applications. Depending on further remote request, a C-GET or a C-MOVE involves the *syngo* RT DICOM Query/Retrieve SCP application to initiate a C-STORE association (by triggering and parameterizing the own Storage SCU) to send objects to a remote Storage SCP.

All components of the DICOM Query/Retrieve SCP application are operating as background server processes. They are available from system start-up and during entire system up-time and respond to queries based on the records stored in its database.

8.3 Sequencing of Real-World Activities

Retrieve of objects is only possible if results from a previous Query operation exist.

9. Application Entity Specification Query/Retrieve

9.1 Query/Retrieve Service AEs Specification

The Query/Retrieve SCU requests that the remote SCP performs a match of all keys specified in the request, against the information in its database and the identified objects will be moved over a different (C-MOVE) storage association.

The Query/Retrieve SCP responds to queries based on the records based on its database and objects will be sent to the requesting SCU or to a different storage destination.

All *syngo* RT DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as SCU:

SOP Class Name	SOP Class UID
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2

All *syngo* RT DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Classes as an SCP:

SOP Class Name	SOP Class UID
Patient Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Patient Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Patient Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.1.3
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3
Patient/Study Only Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient/Study Only Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2
Patient/Study Only Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.3.3

Note: See also the Storage DICOM Conformance Statement of the *syngo* RT DICOM application to compare for conformance of the C-STORE sub-operation generated by the C-GET or C-MOVE DIMSE services. Furthermore compare the supported Storage Service SOP classes described in the Storage DICOM Conformance Statement of the Modality to which the objects shall be transferred to.

9.1.1 Association Establishment Policies

9.1.1.1 General

A Query is used as input for the Search function and the DICOM Query/Retrieve application is started. A Query request will be sent out to one remote node that can be selected from a list of configured Query Providers and the response data will be displayed for the user. Upon request (Import), the retrieval of selected items is initiated.

The default PDU size used will be 28 KB.

9.1.1.2 Number of Associations

The *syngo* RT DICOM application initiates several associations at a time, one for each destination to which a transfer request is being processed in the active job queue list.

The *syngo* RT DICOM application is able to accept multiple associations at a time. It can handle up to 10 associations in parallel.

9.1.1.3 Asynchronous Nature

The *syngo* RT DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

9.1.1.4 Implementation Identifying Information

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

9.1.2 Association Initiation Policy

The query user interface will request the query data from user and triggers one C-FIND request to the selected remote node. The response data will be displayed in the query UI for further data navigation.

When requesting Import of related items the browser requests the retrieve application to send a C-MOVE request to the related remote node. Objects will then be received by the Storage SCP as described in the related section.

9.1.2.1 Real World Activity - Find SCU

9.1.2.1.1 Associated Real-World Activity - Find SCU “Search”

The associated Real-World activity is to fill out a query form with search data and pass it as query to the network application which issues a C-FIND over a previously built association. The remote SCP will respond with related data-entries that will be passed to a browser application. When data transfer is finished the association is closed.

9.1.2.1.2 Proposed Presentation Contexts - Find SCU

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model - FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

It is configurable which of the two query models (or both) are to be used by the *syngo* RT DICOM Query SCU application. If both Abstract Syntaxes are configured, The C-FIND SCU will use the Patient Root Model only for C-FIND requests on PATIENT level. For all other levels it will use the STUDY root model.

9.1.2.1.3 Conformance Statement - Find SCU

The *syngo* RT DICOM Query/Retrieve SCU supports hierarchical queries with all mandatory search keys. The interactive querying of attributes on IMAGE level is not supported by the Query SCU, hence retrieval of individual objects is possible. The following table describes the search keys for the different query models that the SCU supports. Matching is either wildcard, which means that the user can supply a string containing wildcards, or universal, which means that the attribute is requested as return value.

Attribute name	Tag	Type	Matching	User input	Return value display
Patient Level 1					
Patient Name	(0010,0010)	R	Wildcard 2	enter value	yes
Patient ID	(0010,0020)	U	Wildcard 2	enter value	yes
Patient's Birth date	(0010,0030)	O	universal (Null)	enter value	yes
Patient's Sex	(0010,0040)	O	universal (Null)	enter value	yes
Number of Patient related Studies	(0020,1200)	O	universal (Null)	-	yes 3
Number of Patient related Series	(0020,1202)	O	universal (Null)	-	no
Number of Patient related Instances	(0020,1204)	O	universal (Null)	-	no
Study Level					
Patient Name4	(0010,0010)	R	Wildcard 2	enter value	yes
Patient ID	(0010,0020)	R	Wildcard 2	enter value	yes
Patient's Birth date 4	(0010,0030)	O	universal (Null)	enter value	yes
Patient's Sex 4	(0010,0040)	O	universal (Null)	enter value	yes
Study Instance UID	(0020,000D)	U	single value	-	yes
Study ID	(0020,0010)	R	universal (Null)	enter value	yes
Study Date	(0008,0020)	R	universal (Null)	enter value5	yes
Study Time	(0008,0030)	R	universal (Null)	-	yes

1 Patient Root Information Model only
2 Always a '*" is appended to the user-supplied string
3 Implicitly visualized in the UI if no study and series search attributes have been entered
4 Study Root Information Model only
5 Date range also possible

Accession Number	(0008,0050)	R	universal (Null)	-	yes
Study Description	(0008,1030)	O	universal (Null)	-	yes
Referring Physician's Name	(0008,0090)	O	universal (Null)	-	yes
Name of Physician Reading Study	(0008,1060)	O	universal (Null)	-	yes
Modalities in Study	(0008,0061)	O	universal (Null)	-	yes
Storage Media File-Set ID	(0008,0130)	O	universal (Null)	-	no
Retrieve AE Title	(0008,0054)	O	universal (Null)	-	no
Number of Study related Series	(0020,1206)	O	universal (Null)	-	yes6
Number of Study related Instances	(0020,1208)	O	universal (Null)	-	no
Series Level					
Series Instance UID	(0020,000E)	U	single value	-	yes
Series Number	(0020,0011)	R	universal (Null)	-	yes
Modality	(0008,0060)	R	universal (Null)	enter value	yes
Series Date	(0008,0021)	O	universal (Null)	-	yes
Series Time	(0008,0031)	O	universal (Null)	-	yes
Series Description	(0008,103E)	O	universal (Null)	enter value	yes
Body Part Examined	(0018,0015)	O	universal (Null)	enter value	yes
Performing Physician	(0008,1050)	O	universal (Null)	enter value	yes
Storage Media File-Set ID	(0008,0130)	O	universal (Null)	-	yes
Retrieve AE Title	(0008,0054)	O	universal (Null)	-	yes
Protocol Name	(0018,1030)	O	universal (Null)	-	no
Perf. Procedure Step Start Date	(0040,0244)	O	universal (Null)	-	yes
Perf. Procedure Step Start Time	(0040,0245)	O	universal (Null)	-	yes
Requested Attribute Sequence	(0040,0275)	O	universal (Null)	-	yes
> Requested Procedure ID	(0040,1001)	O	universal (Null)	-	yes
> Scheduled Procedure ID	(0040,0009)	O	universal (Null)	-	yes
Number of Series related Instances	(0020,1209)	O	universal (Null)	-	yes
Image Level					
SOP Instance UID	(0008,0018)	U	single value	-	no
Image Number	(0020,0013)	R	universal (Null)	-	yes
Storage Media File-Set ID	(0008,0130)	O	universal (Null)	-	no
Retrieve AE Title	(0008,0054)	O	universal (Null)	-	no
Instance Date	(0008,0023)	O	universal (Null)	-	no
Instance Time	(0008,0033)	O	universal (Null)	-	no
Number of Frames	(0028,0008)	O	universal (Null)	-	yes

[6] Implicitly if no series search attributes have been entered

The Find SCU interprets following status codes:

Service Status	Meaning	Protocol Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

9.1.2.2 Real-World Activity – Move SCU

9.1.2.2.1 Associated Real-World Activity – Move SCU "Import"

When selecting a data entry in the Query UI and activate the "Import" function, a retrieval request is passed to the archival application which issues a C-MOVE service according to the Patient Root or Study Root query model. (The Storage Service Class Conformance Statement describes the C-STORE service, which is generated by processing the C-MOVE service.)

The transferred object data are processed as described in the storage class SCP descriptions.

The possibility to request the remote C-MOVE provider (remote application that responded to the C-FIND) to move data to an application entity other than the C-MOVE SCU (the *syngo* RT DICOM application) is NOT USED.

C-MOVE operation on Patient Level is not supported by the Query UI.

9.1.2.2.2 Proposed Presentation Contexts - Move SCU "Import"

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Note: C-MOVE extended negotiation will not be supported by the SCU

9.1.2.2.3 SOP Specific Conformance Statement - Move SCU "Import"

At association establishment time the C-MOVE presentation context shall be negotiated. The C-STORE sub-operations must be done on a different association to transfer objects to the own Storage Service Class SCP.

The Move SCU interprets following status codes:

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform sub operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	CXXX	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures or Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

9.1.3 Association Acceptance Policy

The *syngo* RT DICOM application will accept associations for the following DIMSE-C operations as SCP:

- C-FIND
- C-GET
- C-MOVE
- C-FIND-CANCEL
- C-GET-CANCEL
- C-MOVE-CANCEL

9.1.3.1 Real-World Activity - Find SCP

9.1.3.1.1 Associated Real-World Activity - Find SCP

The associated Real-World activity is to respond query requests to an SCU with the query model Patient Root, Study Root and Patient/Study Only. Relational retrieve operation is NOT supported. With a C-FIND-CANCEL request the running query can be canceled at any time.

Multiple C-FIND requests over the same association are supported.

9.1.3.1.2 Accepted Presentation Contexts - Find SCP

The *syngo* RT DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Study Root Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Patient/Study Only Query/Retrieve Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

Note: C-FIND Extended Negotiation will NOT be supported.
The order of preference for accepting Transfer Syntaxes is: 1. Explicit VR Little Endian, 2. Explicit VR Big Endian, 3. Implicit VR Little Endian

9.1.3.1.3 SOP Specific Conformance Statement - Find SCP

The *syngo* RT DICOM Query/Retrieve SCP supports hierarchical queries with all mandatory and optional search keys.

The query attribute contents will be treated case-sensitive.

With wildcard queries the symbol "?" is treated as "*" by the C-FIND SCP application. As a consequence the query string of "?abc*" will be processed as "*abc*".

If the value for the patient-level unique key "Patient ID" is not known, it may be returned with zero length. The attribute "Image Comments" will not be included in the C-FIND-RSP, if it is not set in the DB, even if it was requested as return key in the related C-FIND-RQ.

Usage of Storage Media File-Set ID, Retrieve AE Title with C-FIND-RSP message:

The Storage Media File-Set ID - if existent - can be returned at Study/Series/Image Level. Only on Image Level, the values of ONLINE, NEARLINE of OFFLINE are returned to indicate the Storage Location of the related Instance.

The Retrieve AE Title - if existent - can only be returned at Image Level (for Patient Root and Study Root models) or Study Level (for Patient/Study Only model).

Relational Queries are **not** supported.

A remote DICOM AE can cancel the running query by sending a C-FIND-CANCEL. Matches are possibly continuing (more C-FIND response with status PENDING) until the cancel operation has completed.

The supported attributes on the various query levels of the three supported information models are list in the tables of the following sections.

9.1.3.1.3.1 Patient Root Information Model

Attribute Name	**Tag**	**Usage SCU**	**Matching**
Patient Level			
Patient Name	(0010,0010)	R	single value, wildcard, universal
Patient ID	(0010,0020)	U	single value, wildcard, universal
Patient's Birth Date	(0010,0030)	O	single value, range, universal
Patient's Birth Time	(0010,0032)	O	single value, range, universal
Patient's Sex	(0010,0040)	O	single value, wildcard, universal
Ethnic Group	(0010,2160)	O	single value, wildcard, universal
Patient Comments	(0010,4000)	O	wildcard, universal
Number of Patient related Studies	(0020,1200)	O	universal
Number of Patient related Series	(0020,1202)	O	universal
Number of Patient related Instances	(0020,1204)	O	universal
Study Level			

Attribute Name	Tag	Usage SCU	Matching
Study Instance UID	(0020,000D)	U	single value, list of UIDs
Study ID	(0020,0010)	R	single value, wildcard, universal
Study Date	(0008,0020)	R	single value, range, universal
Study Time	(0008,0030)	R	single value, range, universal
Accession Number	(0008,0050)	R	single value, wildcard, universal
Referring Physician's Name	(0008,0090)	O	single value, wildcard, universal
Study Description	(0008,1030)	O	single value, wildcard, universal
Admitting Diagnoses Description	(0008,1080)	O	single value, wildcard, universal
Patient's Age	(0010,1010)	O	single value, wildcard, universal
Patient's Size	(0010,1020)	O	single value, universal
Patient's Weight	(0010,1030)	O	single value, universal
Occupation	(0010,2180)	O	single value, wildcard, universal
Additional Patient History	(0010,21B0)	O	wildcard, universal
Name of Physician reading Study	(0008,1060)	O	single value, wildcard, universal
Modalities in Study	(0008,0061)	O	multiple values, universal
Number of Study related Series	(0020,1206)	O	universal
Number of Study related Instances	(0020,1208)	O	universal
Series Level			
Series Instance UID	(0020,000E)	U	single value, list of UID
Series Number	(0020,0011)	R	single value, universal
Modality	(0008,0060)	R	single value, wildcard, universal
Laterality	(0020,0060)	O	single value, wildcard, universal
Body Part Examined	(0018,0015)	O	single value, wildcard, universal
Patient Position	(0018,5100)	O	single value, wildcard, universal
Smallest Pixel Value in Series	(0028,0108)	O	single value, universal
Largest Pixel Value in Series	(0028,0109)	O	single value, universal
Protocol Name	(0018,1030)	O	single value, wildcard, universal
Series Date	(0008,0021)	O	single value, range, universal
Series Time	(0008,0031)	O	single value, range, universal
Series Description	(0008,103E)	O	single value, wildcard, universal
Operators Name	(0008,1070)	O	single value, wildcard, universal
Performing Physician's Name	(0008,1050)	O	single value, wildcard, universal
Perf. Procedure Step Start Date	(0040,0244)	O	universal
Perf. Procedure Step Start Time	(0040,0245)	O	universal
Number of Series related Instances	(0020,1209)	O	universal
Image Level			
SOP Instance UID	(0008,0018)	U	single value, list of UID
Image Number	(0020,0013)	R	single value, universal
Image Date	(0008,0023)	O	single value, range, universal
Image Time	(0008,0033)	O	single value, range, universal
Modality	(0008,0060)	O	single value, wildcard, universal
Image Comments	(0020,4000)	O	Universal

9.1.3.1.3.2 Study Root Information Model

Attribute Name	Tag	Usage SCU	Matching
Study Level			
Patient Name	(0010,0010)	R	Single value, Wildcard, universal
Patient ID	(0010,0020)	R	Single Value, Wildcard, universal
Patient's Birth Date	(0010,0030)	O	Single Value, Range, universal
Patient's Birth Time	(0010,0032)	O	Single Value, Range, universal
Patient's Sex	(0010,0040)	O	Single Value, Wildcard, universal
Patient Comments	(0010,4000)	O	Wildcard, universal
Number of Patient related Studies	(0020,1200)	O	universal
Number of Patient related Series	(0020,1202)	O	universal

Attribute Name	Tag	Usage SCU	Matching
Number of Patient related Instances	(0020,1204)	O	universal
Study Instance UID	(0020,000D)	U	Single Value, List of UIDs
Study ID	(0020,0010)	R	Single Value, Wildcard, universal
Study Date	(0008,0020)	R	Single Value, Range, universal
Study Time	(0008,0030)	R	Single Value, Range, universal
Accession Number	(0008,0050)	R	Single Value, Wildcard, universal
Referring Physician's Name	(0008,0090)	O	Single Value, Wildcard, universal
Study Description	(0008,1030)	O	Single Value, Wildcard, universal
Admitting Diagnosis Description	(0008,1080)	O	Single Value, Wildcard, universal
Patient's Age	(0010,1010)	O	Single Value, Wildcard, universal
Patient's Size	(0010,1020)	O	Single Value, universal
Patient's Weight	(0010,1030)	O	Single Value, universal
Occupation	(0010,2180)	O	Single Value, Wildcard, universal
Additional Patient History	(0010,21B0)	O	Wildcard, universal
Name of Physician reading the Study	(0008,1060)	O	Single Value, Wildcard, universal
Modalities in Study	(0008,0061)	O	Multiple values, universal
Number of Study Related Series	(0020,1206)	O	universal
Number of Study Related Instances	(0020,1208)	O	universal
Series Level			
Series Instance UID	(0020,000E)	U	Single Value, List of UIDs
Series Number	(0020,0011)	R	Single Value, universal
Modality	(0008,0060)	R	Single Value, Wildcard, universal
Laterality	(0020,0060)	O	Single Value, Wildcard, universal
Body Part Examined	(0018,0015)	O	Single Value, Wildcard, universal
Patient Position	(0018,5100)	O	Single Value, Wildcard, universal
Smallest Pixel Value in Series	(0028,0108)	O	Single Value, universal
Largest Pixel Value in Series	(0028,0109)	O	Single Value, universal
Protocol Name	(0018,1030)	O	Single Value, Wildcard, universal
Series Date	(0008,0021)	O	Single Value, Range, universal
Series Time	(0008,0031)	O	Single Value, Range, universal
Series Description	(0008,103E)	O	Single Value, Wildcard, universal
Operator's Name	(0008,1070)	O	Single Value, Wildcard, universal
Performing Physician's Name	(0008,1050)	O	Single Value, Wildcard, universal
Performed Procedure Step Start Date	(0040,0244)	O	universal
Performed Procedure Step Start Time	(0040,0245)	O	universal
Number of Series related Instances	(0020,1209)	O	universal
Image Level			
SOP Instance UID	(0008,0018)	U	Single Value, List of UIDs
Image Number	(0020,0013)	R	Single Value, universal
Image Date	(0008,0023)	O	Single Value, Range, universal
Image Time	(0008,0033)	O	Single Value, Range, universal
Modality	(0008,0060)	O	Single Value, Wildcard,

Attribute Name	Tag	Usage SCU	Matching
			universal
Image Comments	(0020,4000)	O	universal

9.1.3.1.3.3 Patient/Study Only Information Model

Attribute Name	Tag	Usage SCU	Matching
Patient Level			
Patient Name	(0010,0010)	R	Single value, Wildcard, universal
Patient ID	(0010,0020)	U	Single Value, Wildcard, universal
Patient's Birth Date	(0010,0030)	O	Single Value, Range, universal
Patient's Birth Time	(0010,0032)	O	Single Value, Range, universal
Patient's Sex	(0010,0040)	O	Single Value, Wildcard, universal
Ethnic Group	(0010,2160)	O	Single Value, Wildcard, universal
Patient Comments	(0010,4000)	O	Wildcard, universal
Number of Patient related Studies	(0020,1200)	O	universal
Number of Patient related Series	(0020,1202)	O	universal
Number of Patient related Instances	(0020,1204)	O	universal
Study Level			
Study Instance UID	(0020,000D)	U	Single Value, List of UIDs
Study ID	(0020,0010)	R	Single Value, Wildcard, universal
Study Date	(0008,0020)	R	Single Value, Range, universal
Study Time	(0008,0030)	R	Single Value, Range, universal
Accession Number	(0008,0050)	R	Single Value, Wildcard, universal
Referring Physician's Name	(0008,0090)	O	Single Value, Wildcard, universal
Study Description	(0008,1030)	O	Single Value, Wildcard, universal
Admitting Diagnosis Description	(0008,1080)	O	Single Value, Wildcard, universal
Patient's Age	(0010,1010)	O	Single Value, Wildcard, universal
Patient's Size	(0010,1020)	O	Single Value, universal
Patient's Weight	(0010,1030)	O	Single Value, universal
Occupation	(0010,2180)	O	Single Value, Wildcard, universal
Additional Patient History	(0010,21B0)	O	Wildcard, universal
Name of Physician reading the Study	(0008,1060)	O	Single Value, Wildcard, universal
Modalities in Study	(0008,0061)	O	Multiple values, universal
Number of Study Related Series	(0020,1206)	O	universal
Number of Study Related Instances	(0020,1208)	O	universal

The Find SCP returns following status codes:

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	C001	(0000,0901) (0000,0902)

Service Status	Meaning	Error Codes	Related Fields
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

9.1.3.2 Real-World Activity - Get SCP

9.1.3.2.1 Associated Real-World Activity - Get SCP

The associated Real-World activity is to respond to retrieve requests initiated from a foreign SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class Conformance Statement describes the C-STORE service, which is generated by the C-GET service. Relational retrieve operation is NOT supported.

Multiple C-GET requests over the same association are NOT supported.

9.1.3.2.2 Accepted Presentation Contexts - Get SCP

The *syngo* RT DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model – GET	1.2.840.10008.5.1.4.1.2.1.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Study Root Query/Retrieve Model – GET	1.2.840.10008.5.1.4.1.2.2.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Patient/Study Only Query/Retrieve Model – GET	1.2.840.10008.5.1.4.1.2.3.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

Note: C-GET Extended negotiation will NOT be supported. The order of preference for accepting Transfer Syntaxes is: 1. Explicit VR Little Endian, 2. Explicit VR Big Endian, 3. Implicit VR Little Endian.

9.1.3.2.3 SOP Specific Conformance Statement - Get SCP

At association establishment time the C-GET presentation context must be negotiated along with the C-STORE sub-operations which must be accomplished on the same association as the C-GET operation. Relational retrieve operation is NOT supported.

All unique keys have to be supplied according to the selected Query/Retrieve Level. The related tables in the C-FIND SCP section will give information about “U” marked key attributes.

The Get SCP returns following status codes:

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform sub operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	C001	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

9.1.3.3 Real-World Activity - Move SCP

9.1.3.3.1 Associated Real-World Activity - Move SCP

The associated Real-World activity is to respond to retrieve requests to an SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class Conformance Statement describes the C-STORE service, which is generated by the C-MOVE service. Relational retrieve operation is NOT supported.

Multiple C-MOVE requests over the same association are NOT supported.

9.1.3.3.2 Accepted Presentation Contexts - Move SCP

The *syngo* RT DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Patient/Study Only Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

Note: C-MOVE Extended negotiation will NOT be supported.
The order of preference for accepting Transfer Syntaxes is: 1. Explicit VR Little Endian, 2. Explicit VR Big Endian, 3. Implicit VR Little Endian.

9.1.3.3.3 SOP Specific Conformance Statement - Move SCP

At association establishment time the C-MOVE presentation context shall be negotiated. The C-STORE sub-operations is done on a different association, specified in the C-MOVE request, to transfer objects to a remote SCP of the Storage Service Class. Relational retrieve operation is NOT supported.

All unique keys have to be supplied according to the selected Query/Retrieve Level. The related tables in the C-FIND SCP section will give information about “U” marked key attributes.

The Move SCP returns following status codes:

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources - Unable to calculate number of matches	A701	(0000,0902)
	Out of Resources - Unable to perform sub operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	C001	(0000,0901) (0000,0902)
Cancel	Sub-operations terminated due to Cancel Indication	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Warning	Sub-operations Complete - One or more Failures of Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Success	Sub-operations Complete - No Failures or Warning	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)
Pending	Sub-operations are continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)

10. Implementation Model Print

The Print Management Service Classes define an application-level class of services, which facilitate the printing of images on a hardcopy medium. The print management SCU and print management SCP are peer DICOM print management application entities. The *syngo* DICOM print application supports the print management DIMSE services to act as SCU.

10.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU for the print management network service.

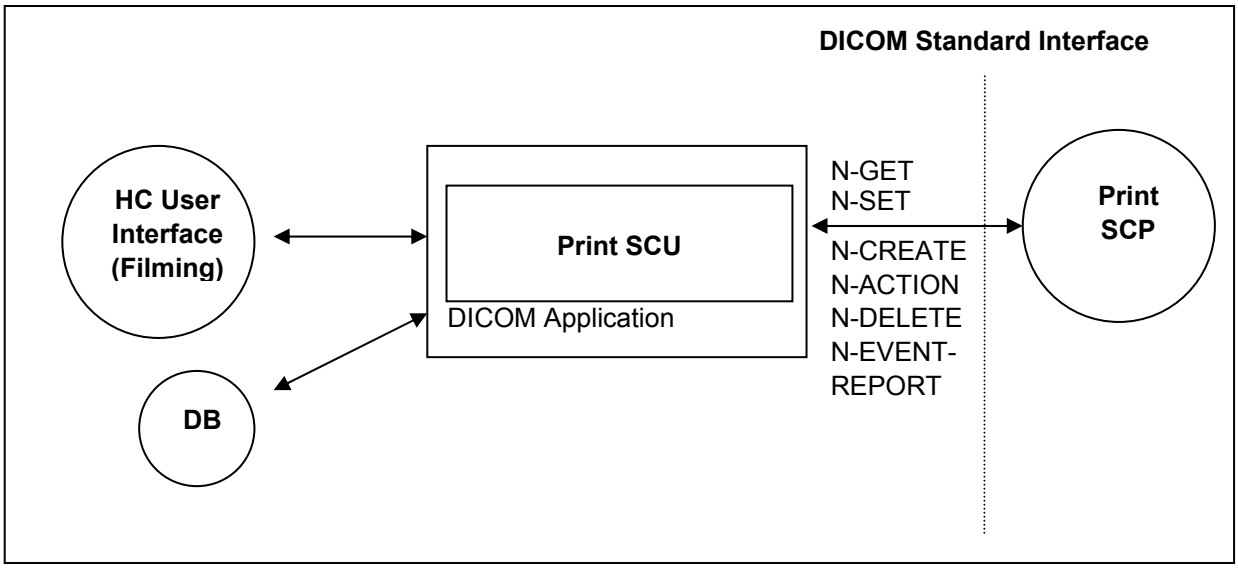


Figure 6: DICOM Application Data Flow Diagram – Print SCU

10.2 Functional Definition of Application Entities

The Print SCU is invoked by the user interface to setup film-sheet layout and whenever an image is ready to be printed on film. The Print SCU will hold and maintain all data needed to compile a complete film-sheet from the data (images, layout, configuration) received. Whenever a film-sheet is ready to print the related data is used to supply the Information to the SOP Classes of the Print Management Service Class. A queue is maintained, in order to intermediately store several film-sheets in case of resource problems on printer. The SCU will only supply and require the mandatory SOP Classes of the Print Management Service Class.

10.3 Sequencing of Real-World Activities

Not applicable.

11. Application Entity Specification Print

11.1 Print Management AE Specification

The *syngo* print management SCU (HCS) invokes print management DIMSE services to transfer images from the local AE to the remote SCP AE to print images with defined layout on a selected network-based DICOM hardcopy printer. This is done in an “full-page” print mode.

SIEMENS *syngo* DICOM products provide Standard Conformance to the following DICOM V3.0 Print Management Meta SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
- Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
- Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
- Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
- Printer SOP Class	1.2.840.10008.5.1.1.16
Print Job SOP Class	1.2.840.10008.5.1.1.14
Presentation LUT SOP Class	1.2.840.10008.5.1.1.23

SOP Class Name	SOP Class UID
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18
- Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
- Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
- Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
- Printer SOP Class	1.2.840.10008.5.1.1.16
Print Job SOP Class	1.2.840.10008.5.1.1.14

11.1.1 Association Establishment Policies

11.1.1.1 General

Whenever a film is completely set up and printed by command or automatism, the job is prepared for processing. As soon as the queue is ready to process the job is activated and worked according the processing data. The related Print application will initiate an association to the print destination and process the printing of the related information. <modify this value according to the product configuration:>

The default PDU size used will be 28 KB.

11.1.1.2 Number of Associations

The *syngo* DICOM Print application initiates one association at a time for each different print device configured.

11.1.1.3 Asynchronous Nature

The *syngo* DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

11.1.1.4 Implementation Identifying Information

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

11.1.2 Association Initiation Policy

Triggered by the Print job queue the Print Management SCU establishes an association by using the DICOM association services. With the help of the N-GET request for the Printer SOP Class the Status is determined before printing.

With no problem encountered with the N-CREATE/N-SET Services for the related Basic Print SOP Classes the film sheet is set up for printing and the image(s) is(are) transferred to the printer device.

After the last film is printed from queue, the Print application will leave open the association for another 60 seconds. If a new film job is ready for printing within this time-limit, the job will be immediately processed over the still open association. If there is no new job, the association is closed if the time-out elapsed. This is done to optimize automated printing.

During the “idle-time” (no open association to printer) the Print application will issue a cyclic camera status request (using N-GET of Printer SOP Class) every 5 minutes.

11.1.2.1 Associated Real-World Activity

11.1.2.1.1 Associated Real-World Activity – Printing a Printer Job Queue Entry

Whenever a film-sheet is prepared by the user, it is forwarded to the Printer Job queue. As soon as the associated Printer device is available the job is activated and association is set up.

The film sheet is internally processed, converted to a Standard/1-1 page and then the page image is sent. Status is controlled by awaiting any N-EVENT message all through the transfer until the last image or film-sheet is sent.

If the response from the remote application contains a status other than Success or Warning the association is aborted.

11.1.2.1.2 Proposed Presentation Context - Print

The Siemens *syngo* DICOM Print application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Basic Grayscale Print Management Meta SOP class	1.2.840.10008.5.1.1.9	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Basic Color Print Management Meta SOP class	1.2.840.10008.5.1.1.18	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Basic film session SOP class	1.2.840.10008.5.1.1.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Basic Film Box SOP class	1.2.840.10008.5.1.1.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Basic Grayscale Image Box SOP class	1.2.840.10008.5.1.1.4	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Basic Color Image Box SOP class	1.2.840.10008.5.1.1.4.1	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Printer SOP class	1.2.840.10008.5.1.1.16	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Print Job SOP class	1.2.840.10008.5.1.1.14	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Presentation LUT SOP class	1.2.840.10008.5.1.1.23	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

11.1.2.1.3 SOP Specific Conformance Statement – Meta SOP Classes

The *syngo* DICOM print management SCU conforms to the DICOM Basic Grayscale Print Management Meta SOP Class and the Basic Color Print Management Meta SOP Class.

The application uses a setting platform to define the properties of the connected DICOM SCP, e.g.:

- maximum number of print jobs in the queue
- maximum number of print copies
- supported film sizes of the connected DICOM SCP
- supported film formats of the DICOM SCP
- lookup table definition.

The printing is only suspended in the case of a failure return status of the SCP.

11.1.2.1.3.1 Basic Film Session SOP Class

The Basic Film Session information object definition describes all the user-defined parameters, which are common for all the films of a film session. The Basic Film Session refers to one or more Basic Film Boxes and that are printed on one hardcopy printer.

The *syngo* DICOM print management SCU supports the following DIMSE Service elements for the Basic Film Session SOP Class as SCU:

- N-CREATE, N-DELETE

The Basic Film Session SOP Class N-CREATE-RQ (SCU) uses the following attributes:

Attribute Name	Tag	Usage SCU	Supported Values
Number of Copies	(2000,0010)	U	1
Medium Type	(2000,0030)	U	BLUE FILM CLEAR FILM PAPER
Film Destination	(2000,0040)	U	MAGAZINE PROCESSOR

The number of Copies sent to the DICOM Printer is always 1, the job is sent n times for n copies.

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and used for later requests (e.g. N-DELETE-RQ) on the Basic Film Session – see below:

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0000,1000) → (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Basic Film Session

The N-DELETE-RQ on the Basic Film Session SOP Class is used to remove the complete Basic Film Session SOP Instance hierarchy.

The Basic Film Session SOP class interprets the following status codes (from N-CREATE-RSP, N-DELETE-RSP messages):

Service Status	Meaning	Error Codes
Failed	Film session SOP instances hierarchy does not contain film box SOP instances	C600
	Unable to create print job, print queue is full	C601
	Image size is larger than images box size	C603
Warning	Memory allocation not supported	B600
	Film session printing is not supported	B601
	Film box does not contain image box (empty page)	B602
Success	Film belonging to the film session are accepted for printing	0000

11.1.2.1.3.2 Basic Film Box SOP Class

The Basic Film Box information object definition describes all the user-defined parameter of one film of the film session. The Basic Film Box information description defines the presentation parameters, which are common for all images on a given sheet of film.
The Basic Film Box refers to one or more Image Boxes.

Supported Service Elements as SCU are:

- N-CREATE
- N-ACTION
- N-DELETE

The Basic Film Box SOP class N-CREATE-RQ message uses the following attributes (the actual values for each attribute depend on DICOM printer configuration within the *syngo* DICOM print management SCU):

Attribute Name	Tag	Usage SCU	Supported Values
Image Display Format	(2010,0010)	M	STANDARD\1,1
Referenced Film Session Sequence	(2010,0500)	M	
> Referenced SOP Class UID	(0008,1150)	M	1.2.840.10008.5.1.1.1
> Referenced SOP Instance UID	(0008,1155)	M	
Film Orientation	(2010,0040)	M	PORTRAIT
Film Size ID	(2010,0050)	M	8INX10IN, 10INX12IN, 10INX14IN, 11INX14IN,, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM
Magnification Type	(2010,0060)	M	BILINEAR, CUBIC, NONE, REPLICATE
Border Density	(2010,0100)	U	BLACK, WHITE
Max Density	(2010,0130)	U	0 < Value
Min Density	(2010,0120)	U	0 < Value < 50
Illumination	(2010,015E)	U	0 < Value Required if

Attribute Name	Tag	Usage SCU	Supported Values
			Presentation LUT is present.
Reflective Ambient Light	(2010,0160)	U	0 < Value Required if Presentation LUT is present.
Referenced Presentation LUT Sequ.	(2050,0500)	U	

The N-CREATE-RSP message from the Print SCP includes the Referenced Image Box Sequence with SOP Class/Instance UID pairs which will be kept internally to be further used for the subsequent Basic Image Box SOP Class N-SET-RQ messages.

When all Image Boxes (including parameters) for the film-sheet have been set, the *syngo* DICOM print manager will issue a N-ACTION-RQ message with the SOP Instance UID of the Basic Film Box and the Action Type ID of 1.

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and used for later requests (e.g. N-DELETE-RQ) on the Basic Film Box - see below:

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0000,1000) → (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Basic Film Box

The Basic Film Box SOP class interprets the following status codes:

Service Status	Meaning	Error Codes
Failure	Unable to create print job, print queue is full	C602
	Image size is larger than images box size	C603
Warning	Film box does not contain image box (empty page)	B603
	Requested MinDensity or MaxDensity outside of Printer's operating range	B605
Success	Film accepted for printing	0000

11.1.2.1.3.3 Basic Grayscale Image Box SOP Class

The Basic Grayscale Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the presentation parameters and image pixel data, which apply to a single image of a sheet of film.

The Grayscale Image Box SOP Class uses only the N-SET-RQ with the following attributes:

Attribute Name	Tag	Usage SCU	Supported Values
Image Position	(2020,0010)	M	1
BASIC Grayscale Image Sequence	(2020,0110)	M	
> Samples per Pixel	(0028,0002)	M	1
> Photometric Interpretation	(0028,0004)	M	MONOCHROME2
> Rows	(0028,0010)	M	
> Columns	(0028,0011)	M	
> Pixel Aspect Ratio	(0028,0034)	M	
> Bits Allocated	(0028,0100)	M	8, 16
> Bits Stored	(0028,0101)	M	8, 12
> High Bit	(0028,0102)	M	7, 11
> Pixel Representation	(0028,0103)	M	0
> Pixel Data	(7FE0,0010)	M	

The Grayscale Image Box SOP class interprets the following status codes:

Service Status	Meaning	Error Codes
Failure	Image contains more pixel than printer can print in Image Box	C603
	Insufficient memory in printer to store the image	C605
Warning	Requested MinDensity or MaxDensity outside of Printer's operating range	B605
Success		0000

11.1.2.1.3.4 Basic Color Image Box SOP Class

The Basic Color Image Box information object definition is the presentation of an image and image related data in the image area of a film. The Basic Image Box information describes the presentation parameters and image pixel data, which apply to a single image of a sheet of film.

The Color Image Box SOP Class uses only the N-SET-RQ with the following attributes:

Attribute Name	Tag	Usage SCU	Supported Values
Image Position	(2020,0010)	M	1
BASIC Color Image Sequence	(2020,0111)	M	
> Samples per Pixel	(0028,0002)	M	3
> Photometric Interpretation	(0028,0004)	M	RGB
> Planar Configuration	(0028,0006)	M	0
> Rows	(0028,0010)	M	
> Columns	(0028,0011)	M	
> Pixel Aspect Ratio	(0028,0034)	M	
> Bits Allocated	(0028,0100)	M	8
> Bits Stored	(0028,0101)	M	8
> High Bit	(0028,0102)	M	7
> Pixel Representation	(0028,0103)	M	0
> Pixel Data	(7FE0,0010)	M	

The Color Image Box SOP class interprets the following status codes:

Service Status	Meaning	Error Codes
Failure	Image contains more pixel than printer can print in Image Box	C603
	Insufficient memory in printer to store the image	C605
Warning	Image size larger than image box size	B604
Success		0000

11.1.2.1.3.5 Presentation LUT SOP Class

The objective of the Presentation LUT is to realize image hardcopy printing tailored for specific modalities, applications and user preferences.

The output of the Presentation LUT is Presentation Values (P-Values). P-Values are approximately related to human perceptual response. They are intended to facilitate common input for hardcopy. P-Values are intended to be independent of the specific class or characteristics of the hardcopy device.

The Presentation LUT SOP Class uses only the N-CREATE-RQ with the following attributes:

Attribute Name	Tag	Usage SCU	Supported Values
Presentation LUT Shape	(2050,0020)	U	IDENTITY

The affected SOP Instance UID received with N-CREATE-RSP message will be kept internally and is used for later requests on the Basic Film Box (N-CREATE-RQ) and on the Presentation LUT (N-DELETE-RQ) - see below:

Attribute Name	Tag	Source of Information
Requested SOP Instance UID	(0000,1000) → (0000,1001)	Affected SOP Instance UID of N-CREATE-RSP on Presentation LUT

The Presentation LUT SOP class interprets the following status codes:

Service Status	Meaning	Error Codes
Warning	Requested MinDensity or MaxDensity outside of HCD's operating range. HCD will use its respective minimum or maximum density value instead.	B605
Success	Presentation LUT successfully created	0000

11.1.2.1.3.6 Printer SOP Class

The Printer SOP Class is the possibility to monitor the status of the hardcopy printer in a synchronous and an asynchronous way.

The SCU uses the mandatory N-EVENT Report DIMSE service to monitor the changes of the printer status in an asynchronous way.

It can directly ask the Printer (SCP) for its status or receive Events from the Printer asynchronously:

- N-GET as SCU

N-EVENT-REPORT as SCU In both cases the following information is supported:

Event-type Name	Event	Attributes	Tag	Usage SCU
Normal	1			
Warning	2	Printer Status Info	(2110,0020)	U
Failure	3	Printer Status Info	(2110,0020)	U

11.1.2.1.3.6.1 Mandatory Printer N-GET-RSP, N-EVENT-REPORT-RQ attributes

Attribute Name	Tag	Usage SCP	Supported Values
Printer Status	(2110,0010)	M	NORMAL, FAILURE, WARNING
Printer Status Info	(2110,0020)	M	See tables in Annex for details.

Note: For a detailed description on how *syngo* reacts on different printer status messages, please refer to the Annex section "DICOM Print SCU – detailed status displays".

11.1.2.1.3.7 Print Job SOP Class

The Print Job SOP Class is the possibility to monitor the execution of the print process.

The *syngo* DICOM Print Management application supports the optional N-EVENT-REPORT DICMSE Service to receive the changes of the Print Job Status in an asynchronous way.

It can receive Events from the Print SCP asynchronously.

Note: *syngo* does not support receiving N-EVENT from camera during print sessions, normally this is configurable in the camera.

N-EVENT-REPORT The following information is supported:

Event-type Name	Event	Attributes	Tag	Usage SCU
Normal	1	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	-- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U

Event-type Name	Event	Attributes	Tag	Usage SCU
Printing	2	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	-- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Done	3	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	-- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U
Failure	4	Execution Status Info	(2100,0030)	U
		Print Job ID	(2100,0010)	-- (Print Queue Management SOP Class not supported)
		Film Session Label	(2000,0050)	U
		Printer Name	(2110,0030)	U

Note: For a detailed description on how *syngo* reacts on different printer status messages, please refer to the Annex section “DICOM Print SCU – detailed status displays”.

11.1.3 Association Acceptance Policy

Not applicable.

12. Implementation Model Worklist

The Basic Worklist Management Service class defines an application-level class of service, which facilitates the transfer of worklists from the information system to the imaging modality. The worklist is queried by the AE and supplies the SCU with the scheduled tasks, which have to be performed on the modality. The *syngo* RT DICOM worklist application supports the worklist service as SCU.

12.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU for the Basic Worklist Service using the Modality Worklist SOP Class.

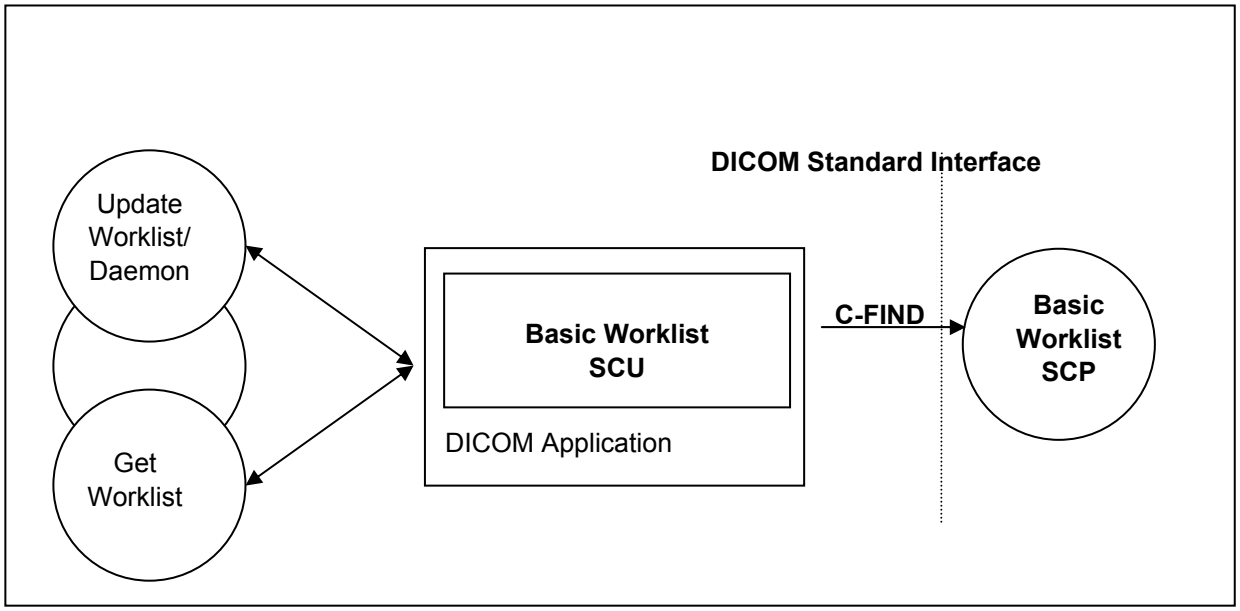


Figure 7: syngo RT Application Flow Diagram – Basic Worklist SCU

12.2 Functional Definitions of Application Entities

The worklist SCU (“broad query”) is invoked from the patient browser user interface or by timer to request the worklist from a remote Information System (Modality Worklist Class SCP). This is done to perform a match to the internal worklist query keys specified in the C-Find DIMSE service issued for the Modality Worklist Model.

The worklist SCP responses to the C-FIND query and scheduled imaging service requests (scheduled procedure steps) and patient demographic information will be downloaded from the information system to the *syngo* RT modality. All information retrieved will be hold in the scheduling database for usage during Patient registration procedure.

Furthermore the patient based Query dialog from the patient browser allows to enter specific matching criteria ("narrow query") for the issue worklist query. With the response data the Patient Registration dialog can be populated according availability within the worklist response identifier.

12.3 Sequencing of Real-World Activities

The “narrow” (interactive) Worklist Query requires that sufficient matching keys or a unique matching key are/is entered before the query is issued. Only then a single response can be expected to complete the registration dialog.

13. Application Entity Specification Worklist

13.1 Modality Worklist Service AE Specification

The Modality worklist SCU (patient registration in conjunction with the network application) requests that the remote SCP performs a match of all keys specified in the query against the information in its worklist database.

The *syngo* RT DICOM network implementation acts as SCU for the Basic Worklist Service using the Modality Worklist SOP Class:

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

13.1.1 Association Establishment Policies

13.1.1.1 General

It is possible to configure a cyclic update of the modality scheduler database through a background worklist request with date/time and modality information.

In addition the user can request worklist update with “Update Worklist”. No duplicate entries will be added in the Scheduler DB. Entries are uniquely identified by the Study Instance UID (0020,000D) for the Requested Procedure and the SPS ID (0040,0009) in the SPS Sequence (0040,0100).

An interactive worklist query can be issued with search criteria entered in the patient based Query dialog from the patient browser.

The default PDU size used will be 28 KB.

13.1.1.2 Number of Associations

The *syngo* RT DICOM application initiates one association at a time to query worklist entry data.

13.1.1.3 Asynchronous Nature

The *syngo* RT DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

13.1.1.4 Implementation Identifying Information

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

13.1.2 Association Initiation Policy

The network application will cyclically query the worklist and by request of patient registration interface. Ever then it establishes an association by using the DICOM association services. During association establishment the negotiation of SOP classes to exchange the capabilities of the SCU and the SCP is not supported.

The following DIMSE-C operation is supported as SCU:

- C-FIND

13.1.2.1 Real-World Activity

13.1.2.1.1 Associated Real-World Activity - Query (Update) Worklist

A network application will perform worklist queries with the C-FIND request at regular intervals. In addition it can be triggered by immediate request. The received worklist items will be compared with the contents of the local scheduler database. New items will be inserted into scheduler database.

After each broad-query, all RP/SPS that were canceled or rescheduled to another modality at the RIS will be automatically removed from the Scheduler DB if :

- the Examination of this procedure has not been started or finished yet, and
- the corresponding configuration item “Automatic removal of canceled/rescheduled Request” was checked in the Service UI under DICOM/HIS-RIS Node.

No automatic clean-up of the scheduler DB is performed after a Patient base Query since the worklist received does not give the complete list of all currently scheduled procedures for the modality.

13.1.2.1.2 Proposed Presentation Contexts

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Worklist Information Model-FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

13.1.2.1.3 SOP Specific Conformance Statement

- Search Key Attributes of the Worklist C-FIND

The *syngo* RT DICOM worklist SCU supports “broad worklist queries” with all required search keys. The following tables describe the “broad query” search keys that the SCU supports.

Attribute Name	**Tag**	**Matching Key Type**	**Query Value**
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	
>Scheduled Station AE Title	(0040,0001)	R	<own AET> or “*”[7]
>Scheduled Procedure Step Start Date	(0040,0002)	R	<act. Date>-<act. Date> or range from UI[8]
>Scheduled Procedure Step Start Time	(0040,0003)	R	<zero length> or range from UI2
>Modality	(0008,0060)	R	“*” or <own Modality>1

- Return Key Attributes of the Worklist C-FIND

The *syngo* RT DICOM worklist SCU supports worklist queries with return key attributes of all types. The following tables describe the return keys that the SCU supports.

[7] This depends on user configuration (Options->Configuration->Patient Registration) if the "own AET" is provided or not. Use the "HIS/RIS" tabcard for configuration.

[8] It depends on user configuration (Options->Configuration->Patient Registration) if the actual Date with a full time range or an interactive input dialog for date/time specification is used.

An “x” in the **UI** column will indicate the attribute is visualized when browsing the Worklist results with Patient Browser and/or during Patient Registration. The Patient Browser display is additionally influenced by the related Browser configuration.

A tag in the **IOD** column will indicate that the related attribute is included into the SOP Instances of the IOD’s created during processing of this worklist request.

A tag in the **MPPS** column will indicate that the related attribute is included into the SOP Instances of the MPPS objects created during processing of this worklist request. (See also the tables “Attributes used for the Performed Procedure Step N-CREATE” and “Attributes used for the Performed Procedure Step N-SET”.)

Attribute Name	Tag	Return Key Type	UI	IOD	MPPS
SOP Common					
Specific Character Set	(0008,0005)	1C	-	(0008,0005)	(0008,0005)
Scheduled Procedure Step					
Scheduled Procedure Step Sequence	(0040,0100)	1			
>Modality	(0008,0060)	1	x	(0008,0060)	(0008,0060)
>Requested Contrast Agent	(0032,1070)	2C	x	(0032,1070)	
>Scheduled Station AE Title	(0040,0001)	1	x		(0040,0241)9
>Scheduled Procedure Step Start Date	(0040,0002)	1	x		
>Scheduled Procedure Step Start Time	(0040,0003)	1	x		
>Scheduled Procedure Step End Date	(0040,0004)	3	-		
>Scheduled Procedure Step End Time	(0040,0005)	3	-		
>Scheduled Performing Physician’s Name	(0040,0006)	1	x	(0008,1050)10	(0008,1050)4
>Scheduled Procedure Step Description	(0040,0007)	1C	x	(0040,0007) (0040,0254)11	(0040,0007) (0040,0254)5
>Scheduled Protocol Code Sequence 12	(0040,0008)	1C	-	(0040,0008) (0040,0260)13	(0040,0008) (0040,0260)7
>>Code Value	(0008,0100)	1C	x		
>>Coding Scheme Designator	(0008,0102)	1C	x		
>>Coding Scheme Version	(0008,0103)	3	x		
>>Code Meaning	(0008,0104)	3	x		
>Scheduled Procedure Step ID	(0040,0009)	1	x	(0040,0009) (0040,0253)14	(0040,0009) (0040,0253)1
>Scheduled Station Name	(0040,0010)	2	x		
>Scheduled Procedure Step Location	(0040,0011)	2	x		(0040,0242)15
>Pre-Medication	(0040,0012)	2C	x		
>Scheduled Procedure Step Status	(0040,0020)	3	x		
>Comments on the Scheduled Procedure Step	(0040,0400)	3	-		
Requested Procedure					
Referenced Study Sequence 8	(0008,1110)	2	-	(0008,1110)	(0008,1110)
>Referenced SOP Class UID	(0008,1150)	1C	-		
>Referenced SOP Instance UID	(0008,1155)	1C	-		
Study Instance UID	(0020,000D)	1	-	(0020,000D)	(0020,000D)
Requested Procedure Description	(0032,1060)	1C	x	(0032,1060)	(0032,1060)
Requested Procedure Code Sequence 16	(0032,1064)	1C	-	(0008,1032)17 (0032,1064)	(0008,1032)4
>Code Value	(0008,0100)	1C	x		

[9] “Scheduled Station AE Title” is taken as default for “Performed Station AE Title”
[10] “Scheduled Performing Physician’s Name” is taken as default for “Performing Physician’s Name”
[11] “Scheduled Procedure Step Description” is taken as default for “Performed Procedure Step Description”
[12] Uses universal sequence match
[13] “Scheduled Protocol Code Sequence” is taken as default for “Performed Protocol Code Sequence”
[14] “Scheduled Procedure Step ID” is taken as default for “Performed Procedure Step ID”
[15] “Scheduled Procedure Step Location” is taken as default for “Performed Location”
[16] Uses universal sequence match
[17] “Requested Procedure Code Sequence” is taken as default for “Procedure Code Sequence”

Attribute Name	Tag	Return Key Type	UI	IOD	MPPS
>Coding Scheme Designator	(0008,0102)	1C	x		
>Coding Scheme Version	(0008,0103)	3	x		
>Code Meaning	(0008,0104)	3	x		
Requested Procedure ID	(0040,1001)	1	x	(0040,1001) (0020,0010)18	(0040,1001) (0020,0010)5
Reason for the Requested Procedure	(0040,1002)	3	-		
Requested Procedure Priority	(0040,1003)	2	x		
Patient Transport Arrangements	(0040,1004)	2	-		
Requested Procedure Location	(0040,1005)	3	-		
Confidentiality Code	(0040,1008)	3	-		
Reporting Priority	(0040,1009)	3	-		
Names of intended Recipients of Results	(0040,1010)	3	-	(0008,1048)	
Requested Procedure Comments	(0040,1400)	3	x		
Imaging Service Request					
Accession Number	(0008,0050)	2	x	(0008,0050)	(0008,0050)
Referring Physician's Name	(0008,0090)	2	x	(0008,0090)	
Requesting Physician	(0032,1032)	2	x	(0032,1032)	(0032,1032)
Requesting Service	(0032,1033)	3	x	(0032,1033)	
Reason for the Imaging Service Request	(0040,2001)	3	-		
Issuing Date of Imaging Service Request	(0040,2004)	3	-		
Issuing Time of Imaging Service Request	(0040,2005)	3	-		
Placer Order Number / Imaging Service Request 19	(0040,2016)	3	-		(0040,2016)
Filler Order Number / Imaging Service Request 20	(0040,2017)	3	-		(0040,2017)
Order entered by …	(0040,2008)	3	-		
Order Enterer's location	(0040,2009)	3	-		
Order Callback Phone Number	(0040,2010)	3	-		
Imaging Service Request Comments	(0040,2400)	3	x		
Visit Identification					
Institution Name	(0008,0080)	3	x	(0008,0080)	
Institution Address	(0008,0081)	3	-	(0008,0081)	
Institution Code Sequence 21	(0008,0082)	3	-		
>Code Value	(0008,0100)	1C	-		
>Coding Scheme Designator	(0008,0102)	1C	-		
>Coding Scheme Version	(0008,0103)	3	-		
>Code Meaning	(0008,0104)	3	-		
Admission ID	(0038,0010)	2	x		
Issuer of Admission ID	(0038,0011)	3	-		
Visit Status					
Visit Status ID	(0038,0008)	3	-		
Current Patient Location	(0038,0300)	2	x		
Patient's Institution Residence	(0038,0400)	3	-		
Visit Comments	(0038,4000)	3	-		
Visit Relationship					
Referenced Study Sequence 4	(0008,1110)	3	-		
>Referenced SOP Class UID	(0008,1150)	1C	-		
>Referenced SOP Instance UID	(0008,1155)	1C	-		
Referenced Patient Sequence 4	(0008,1120)	2	-		(0008,1120)
>Referenced SOP Class UID	(0008,1150)	1C	-		
>Referenced SOP Instance UID	(0008,1155)	1C	-		

[18] "Requested Procedure ID" is taken as default for "Study ID"
[19] Old tag (0040,2006) is retired and not used.
[20] Old tag (0040,2007) is retired and not used.
[21] Uses universal sequence match

Attribute Name	Tag	Return Key Type	UI	IOD	MPPS
Visit Admission					
Referring Physician's Name	(0008,0090)	2	x	(0008,0090)	
Referring Physician's Address	(0008,0092)	3	-		
Referring Physician's Phone Numbers	(0008,0094)	3	-		
Admitting Diagnosis Description	(0008,1080)	3	x	(0008,1080)	
Admitting Diagnosis Code Sequence 4	(0008,1084)	3	-		
>Code Value	(0008,0100)	1C	-		
>Coding Scheme Designator	(0008,0102)	1C	-		
>Coding Scheme Version	(0008,0103)	3	-		
>Code Meaning	(0008,0104)	3	-		
Route of Admissions	(0038,0016)	3	-		
Admitting Date	(0038,0020)	3	-		
Admitting Time	(0038,0021)	3	-		
Patient Identification					
Patient's Name	(0010,0010)	1	x	(0010,0010)	(0010,0010)
Patient ID	(0010,0020)	1	x	(0010,0020)	(0010,0020)
Issuer of Patient ID	(0010,0021)	3	-	(0010,0021)	
Other Patient IDs	(0010,1000)	3	x	(0010,1000)	
Other Patient Names	(0010,1001)	3	x	(0010,1001)	
Patient's Birth Name	(0010,1005)	3	-	(0010,1005)	
Patient's Mother's Birth Name	(0010,1060)	3	-	(0010,1060)	
Medical Record Locator	(0010,1090)	3	-	(0010,1090)	
Patient Demographic					
Patient's Birth Date	(0010,0030)	2	x	(0010,0030)	(0010,0030)
Patient's Birth Time	(0010,0032)	3	-	(0010,0032)	
Patient's Sex	(0010,0040)	2	x	(0010,0040)	(0010,0040)
Patient's Insurance Plan Code Sequence 4	(0010,0050)	3	-	(0010,0050)	
>Code Value	(0008,0100)	1C	-		
>Coding Scheme Designator	(0008,0102)	1C	-		
>Coding Scheme Version	(0008,0103)	3	-		
>Code Meaning	(0008,0104)	3	-		
Patient's Age	(0010,1010)	3	x	(0010,1010)	
Patient's Size	(0010,1020)	3	x	(0010,1020)	
Patient's Weight	(0010,1030)	2	x	(0010,1030)	
Patient's Address	(0010,1040)	3	x	(0010,1040)	
Military Rank	(0010,1080)	3	x	(0010,1080)	
Branch of Service	(0010,1081)	3	-	(0010,1081)	
Country of Residence	(0010,2150)	3	-	(0010,2150)	
Region of Residence	(0010,2152)	3	-	(0010,2152)	
Patient's Telephone Numbers	(0010,2154)	3	-	(0010,2154)	
Ethnic Group	(0010,2160)	3	x	(0010,2160)	
Occupation	(0010,2180)	3	-	(0010,2180)	
Patient's Religious Preference	(0010,21F0)	3	-	(0010,21F0)	
Patient Comments	(0010,4000)	3	x	(0010,4000)	
Patient Data Confidentiality Constraint Description	(0040,3001)	2	x	(0040,3001)	
Patient Medical					
Medical Alerts	(0010,2000)	2	x	(0010,2000)	
Contrast Allergies	(0010,2110)	2	x	(0010,2110)	
Pregnancy Status	(0010,21C0)	2	x	(0010,21C0)	
Smoking Status	(0010,21A0)	3	x	(0010,21A0)	
Last Menstrual Date	(0010,21D0)	3	x	(0010,21D0)	
Additional Patient History	(0010,21B0)	3	x	(0010,21B0)	
Special Needs	(0038,0050)	2	x	(0038,0050)	
Patient State	(0038,0500)	2	x	(0038,0500)	

Attribute Name	Tag	Return Key Type	UI	IOD	MPPS
Patient Relationship					
Referenced Study Sequence[1]	(0008,1110)	3	-		
>Referenced SOP Class UID	(0008,1150)	1C	-		
>Referenced SOP Instance UID	(0008,1155)	1C	-		
Referenced Visit Sequence 1	(0008,1125)	3	-		
>Referenced SOP Class UID	(0008,1150)	1C	-		
>Referenced SOP Instance UID	(0008,1155)	1C	-		
Referenced Patient Alias Sequence 1	(0038,0004)	3	-		
>Referenced SOP Class UID	(0008,1150)	1C	-		
>Referenced SOP Instance UID	(0008,1155)	1C	-		

13.1.2.1.4 Associated Real-World Activity – Get Worklist

With "Get Worklist" in the patient based Worklist Query dialog, the entered attributes are used to form a worklist request identifier. With the response data the Patient Registration dialog can be updated to perform examination in advance. The response data are additionally placed in the scheduler database

13.1.2.1.5 Proposed Presentation Contexts – Get Worklist

This RWA will propose the same Presentation Contexts as with “Update Worklist”. Please see table in section 13.1.2.1.2.

13.1.2.1.6 SOP Specific Conformance – Get Worklist

13.1.2.1.6.1 Search Key Attributes of the Worklist C-FIND

The *syngo* RT DICOM worklist SCU supports “narrow worklist queries” with all required search keys. The following tables describe the “narrow query” search keys that the SCU supports.

Attribute Name	Tag	Matching Key Type	Query Value
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	
>Scheduled Performing Physician’s Name	(0040,0006)	R	input from UI or <zero length>
Requested Procedure			
Requested Procedure ID	(0040,1001)	O	input from UI or <zero length>
Imaging Service Request			
Accession Number	(0008,0050)	O	input from UI or <zero length>
Referring Physician’s Name	(0008,0090)	O	input from UI or <zero length>
Visit Status			
Current Patient Location	(0038,0300)	O	input from UI or <zero length>
Patient Identification			
Patient’s Name	(0010,0010)	R	input from UI or <zero length>
Patient ID	(0010,0020)	R	input from UI or <zero length>

13.1.2.1.6.2 Return Key Attributes of the Worklist C-FIND

Please see list for “Update Worklist” RWA.

[1] Uses universal sequence match

13.1.2.1.6.3 Status Codes of the Worklist C-FIND

The worklist SCU interprets following status codes:

Service Status	Meaning	Error Codes	Related Fields
Refused	Out of Resources	A700	(0000,0902)
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)
	Unable to process	Cxxx	(0000,0901) (0000,0902)
Cancel	Matching terminated due to Cancel request	FE00	None
Success	Matching is complete - No final Identifier is supplied	0000	None
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier

14. Implementation Model Modality Performed Procedure Step

The Modality Performed Procedure Step (MPPS) Service class defines an application-level class of service which facilitates the transfer of procedure, billing and radiation dose information from the imaging modality to the information system. The Performed Procedure Step is created and set by the AE and supplies the SCP with the information about a real-world procedure, which is performed on the modality. The *syngo* RT DICOM MPPS application supports the MPPS service as SCU.

14.1 Application Data Flow Diagram

The *syngo* RT DICOM network implementation acts as SCU for the MPPS SOP Class.

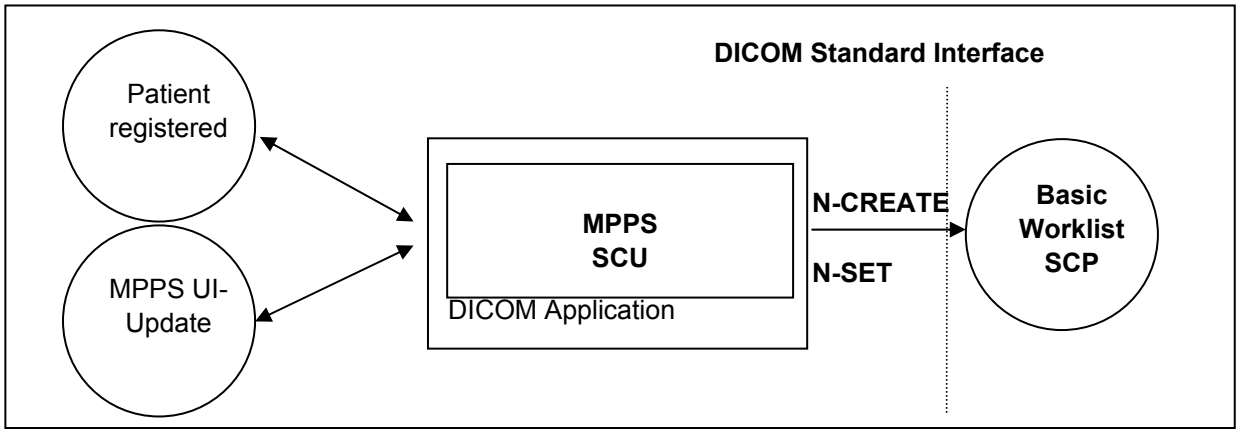


Figure 8: Application Flow Diagram – MPPS SCU

14.2 Functional Definitions of Application Entities

With registering a Patient (i.e. a Scheduled Procedure Step from Worklist), the *syngo* RT DICOM application will create a MPPS Instance and communicate it to the MPPS SCP.

Furthermore a manual update can be performed with the *syngo* RT MPPS user interface. Only there it is possible to set the state of the MPPS to “Completed” or “Discontinued”. If done so, the DICOM application will no longer allow updates on the related MPPS Instance.

The *syngo* RT application will not only allow a "1:1 -relationship" of Scheduled Procedure Steps and Performed Procedure Steps, but also supports the "simple group-case" (grouping several SPS of the same Requested Procedure) , "complex group-case" (grouping several SPS from different Requested Procedures) and "append case" from the respective IHE-scenarios.

The *syngo* RT application will support creation of “unscheduled cases” by allowing MPPS Instances to be communicated for locally registered Patients.

15. Application Entity Specification MPPS

15.1 Modality Performed Procedure Step AE Specification

The Modality Performed Procedure Step SCU (Patient Registration and MPPS UI) provide information about a performed real-world Procedure to a remote SCP (Information System).

All *syngo* RT DICOM products provide Standard Conformance to the following DICOM V3.0 SOP Class as an SCU:

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

15.1.1 Association Establishment Policies

15.1.1.1 General

The creation of MPPS Instance is done automatically by *syngo* RT applications whenever a patient is registered for image acquisition through the Patient Registration dialog.

Further updates on the MPPS data can be done interactively from the related MPPS user interface. The MPPS “Complete” or “Discontinued” states can only be set from user interface.

The default PDU size used will be 28 KB.

15.1.1.2 Number of Associations

The *syngo* RT DICOM application initiates one association at a time to create or set MPPS instance.

15.1.1.3 Asynchronous Nature

The *syngo* RT DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

15.1.1.4 Implementation Identifying Information

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

15.1.2 Association Initiation Policy

The *syngo* RT DICOM Application Entity acts as a Service Class User (SCU) for the

- Modality Performed Procedure Step Service Class (to notify a RIS about status of a procedure while it is performed).

To do so, the *syngo* RT application will issue an

- N-CREATE DIMSE according to the CREATE Modality Performed Procedure Step SOP Instance operation or a
- N-SET DIMSE to update the contents and state of the MPPS according to the SET Modality Performed Procedure Step Information operation.

15.1.2.1 Real-World Activity

15.1.2.1.1 Associated Real-World Activity - Patient Registered

A patient is registered by the Patient Registration “Exam” action. From this event the trigger to create a MPPS Instance is derived. The related Instance is then immediately communicated to the configured RIS system. An association is established and the MPPS Instance is sent.

15.1.2.1.2 Proposed Presentation Contexts - Patient Registered

The *syngo* RT DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

15.1.2.1.3 SOP Specific Conformance Statement- Patient Registered

15.1.2.1.3.1 Attributes used for the Performed Procedure Step N-CREATE

The *syngo* RT DICOM Modality Performed Procedure Step SCU informs the remote SCP when the examination of a scheduled procedure step will be performed (i.e. the patient is registered). The N-CREATE message is sent when the examination is started with successful registration of the patient data. The following table describes the supported attributes of a N-CREATE message.

Attribute Name	**Tag**	**Type**	**Value**
SOP Common			
Specific Character Set	(0008,0005)	1C	from MWL or created
Performed Procedure Step Relationship			
Scheduled Step Attribute Sequence	(0040,0270)	1	
>Study Instance UID	(0020,000D)	1	from MWL or created
>Referenced Study Sequence	(0008,1110)	2	from MWL or <zero length>
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Accession Number	(0008,0050)	2	from MWL or user input
>Placer Order Number/Imaging Service Request	(0040,2016)	3	from MWL or <zero length>
>Filler Order Number/Imaging Service Request	(0040,2017)	3	from MWL or <zero length>
>Requested Procedure ID	(0040,0001)	2	from MWL or user input
>Requested Procedure Description	(0032,1060)	2	from MWL or <zero length>
>Scheduled Procedure Step ID	(0040,0009)	2	from MWL or <zero length>
>Scheduled Procedure Step Description	(0040,0007)	2	from MWL or <zero length>
>Scheduled Action Item Sequence	(0040,0008)	2	from MWL or <zero length>
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Coding Scheme Version	(0008,0103)	3	
>>Code Meaning	(0008,0104)	3	
Patient’s Name	(0010,0010)	2	from MWL or user input
Patient ID	(0010,0020)	2	from MWL or user input
Patient’s Birth Date	(0010,0030)	2	from MWL or user input
Patient’s Sex	(0010,0040)	2	from MWL or user input
Referenced Patient Sequence	(0008,1120)	2	from MWL or <zero length>
>Referenced SOP Class UID	(0008,1150)	1C	

Attribute Name	Tag	Type	Value
>Referenced SOP Instance UID	(0008,1155)	1C	
Performed Procedure Step Information			
Performed Procedure Step ID	(0040,0253)	1	From SPS ID or created
Performed Station AE Title	(0040,0241)	1	own AE Title
Performed Station Name	(0040,0242)	2	own hostname
Performed Location	(0040,0243)	2	from SPS location or <zero length>
Performed Procedure Step Start Date	(0040,0244)	1	created
Performed Procedure Step Start Time	(0040,0245)	1	created
Performed Procedure Step Status	(0040,0252)	1	“IN PROGRESS”
Performed Procedure Step Description	(0040,0254)	2	from SPS Description or <zero length>
Performed Procedure Type Description	(0040,0255)	2	<zero length>
Procedure Code Sequence	(0008,1032)	2	from Requested Procedure Code or <zero length>
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Procedure Step End Date	(0040,0250)	2	<zero length>
Performed Procedure Step End Time	(0040,0251)	2	<zero length>
Image Acquisition Results			
Modality	(0008,0060)	1	<modify/insert value>
Study ID	(0020,0010)	2	from Requested Procedure ID or created
Performed Protocol Code Sequence	(0040,0260)	2	from Scheduled Action Item Sequence or <zero length>
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	2	
>Performing Physician’s Name	(0008,1050)	2C	from MWL or user input
>Operator’s Name	(0008,1070)	2C	User input
>Series Instance UID	(0020,000E)	1C	created
>Series Description	(0008,103E)	2C	<zero length>
>Retrieve AE Title	(0008,0054)	2C	<zero length>
>Protocol Name	(0018,1030)	N/a	User-defined description of the conditions under which the Series was performed.
>Referenced Image Sequence	(0008,1140)	2C	<zero length>
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C	<zero length>
All other attributes from Radiation Dose Module		3	<modify and add attributes as setup for this <product> application>
All other attributes from Billing and Material Code Module		3	<modify and add attributes as setup for this <product> application>

15.1.2.1.3.2 Status Codes of the Performed Procedure Step N-CREATE

The Performed Procedure Step SCU interprets following status codes:

Service Status	Meaning	Error Codes (0000.0900)
Failure	Processing Failure	0110
	No such attribute	0105
	Invalid attribute value	0106
	Duplicate SOP Instance	0111
	No such SOP Instance	0112
	No such SOP Class	0118
	Class Instance conflict	0119
	Missing attribute	0120
	Missing attribute value	0121
	Resource limitation	0213
Success	MPPS Instance created	0000

15.1.2.1.4 Associated Real-World Activity – MPPS UI-Update

With the MPPS UI the status of the MPPS Instance can be set to “COMPLETED” or “DISCONTINUED”. There is no cyclic update during performance of the procedure.

15.1.2.1.5 Proposed Presentation Contexts – MPPS UI-Update

This RWA will propose the same Presentation Contexts as with “Patient registered”. Please see table in section 15.1.2.1.2.

15.1.2.1.6 SOP Specific Conformance Statement – MPPS UI-Update

15.1.2.1.6.1 Attributes used for the Performed Procedure Step N-SET

The *syngo* RT DICOM Modality Performed Procedure Step SCU informs the remote SCP about the performed examination and its status. The N-SET message is sent only per ended examination (finished status “COMPLETED” or incomplete status “DISCONTINUED”). The following table describes the supported attributes of a N-SET message.

Attribute Name	Tag	Type	Value
Performed Procedure Step Information			
Performed Procedure Step Status	(0040,0252)	3	“COMPLETED” or “DISCONTINUED”
Performed Procedure Step Description	(0040,0254)	3	from SPS Description or user input
Performed Procedure Type Description	(0040,0255)	3	User input
Procedure Code Sequence	(0008,1032)	3	from Requested Procedure Code
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Procedure Step End Date	(0040,0250)	1	created
Performed Procedure Step End Time	(0040,0251)	1	created
Image Acquisition Results			
Performed Protocol Code Sequence	(0040,0260)	3	from Scheduled Action Item Sequence
>Code Value	(0008,0100)	1C	

Attribute Name	Tag	Type	Value
>Coding Scheme Designator	(0008,0102)	1C	
>Coding Scheme Version	(0008,0103)	3	
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	1	
>Performing Physician's Name	(0008,1050)	2C	from MWL or user input
>Protocol Name	(0018,1030)	1C	from related SOP Instance
>Operator's Name	(0008,1070)	2C	user input
>Series Instance UID	(0020,000E)	1C	from related SOP Instance
>Series Description	(0008,103E)	2C	from related SOP Instance
>Retrieve AE Title	(0008,0054)	2C	from Storage Commitment response or <zero length>
>Referenced Image Sequence	(0008,1140)	2C	<zero length>
>>Referenced SOP Class UID	(0008,1150)	1C	
>>Referenced SOP Instance UID	(0008,1155)	1C	
>Referenced Standalone SOP Instance Sequence	(0040,0220)	2C	<zero length>
All other attributes from Radiation Dose Module		3	
All other attributes from Billing and Material Code Module		3	

15.1.2.1.6.2 Status Codes of the Performed Procedure Step N-SET

The Performed Procedure Step SCU interprets following status codes:

Service Status	Meaning	Error Codes (0000.0900)
Failure	Processing Failure: Performed Procedure Step Object may no longer be updated.	0110
	No such attribute	0105
	Invalid attribute value	0106
	No such SOP Instance	0112
	Invalid Object instance	0117
	No such SOP Class	0118
	Class Instance conflict	0119
	Missing attribute value	0121
	Resource limitation	0213
Success	MPPS Instance set	0000

16. Communication Profiles

16.1 Supported Communication Stacks

The *syngo* RT DICOM application provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.
The product target Operating System is Microsoft Windows XP Professional with Service Pack 2.

16.1.1 TCP/IP Stack

The *syngo* RT DICOM application uses the TCP/IP stack from the target operating system upon which it executes. It uses the MergeCOM-3 subroutine library from Merge Technologies Inc. that is based on a Berkeley socket interface.

16.1.1.1 API

The *syngo* RT DICOM application uses the Merge COM library that is based on a TCP/IP socket interface.

16.1.1.2 Physical Media Support

The *syngo* RT DICOM application is indifferent to the physical medium over which TCP/IP executes; it inherits this from the target operating system upon which it executes.

17. Extensions / Specializations / Privatizations

17.1 Standard Extended / Specialized / Private SOPs

Please refer to the Annex for further information on these topics. A detailed overview is given there.

17.2 Private Transfer Syntaxes

Not applicable.

18. Configuration

18.1 AE Title/Presentation Address Mapping

To ensure unique identification within the network the hostname should be used as part of the AE Titles (see examples below, hostname = name1). The string can be up to 16 characters long and must not contain any extended characters, only 7-bit ASCII characters (excluding Control Characters) are allowed according to DICOM Standard.

Note: The current implementation of *syngo* does not support the full DICOM Standard. Spaces and special characters (like &<> ") in the AE title string are not supported.

18.1.1 DICOM Verification

The Verification Service uses the AE configuration of the DICOM Service that is checked with the C-ECHO message. E.g. Verification will use the Storage AE, if initiated to check the configuration of a remote DICOM node.

18.1.2 DICOM Storage AE Title

Within *syngo*, there are local application entity titles for HIS/RIS, Study Transfer and Print. They can be configured via Service-UI in Configuration / DICOM / General (e.g. STU_NAME1).

The port number is set to the fixed value of 104.

18.1.3 DICOM Query/Retrieve AE Title

The DICOM Query/Retrieve application uses the same application entity title as the DICOM Storage AE.

18.1.4 DICOM Print AE Title

The DICOM Print application provides the application entity title:

e.g., PRI_NAME1 (No input of AETs starting with a numeric character is possible)

18.2 Configurable Parameters

The Application Entity Titles, host names and port numbers for remote AE are configured using the *syngo* RT Service/Installation Tool. For each AET the list of services supported can be configured.

18.2.1 Storage, Storage Commitment and Query/Retrieve

The *syngo* RT Service/Installation Tool can be used to set the AET's, port-numbers, host-names, IP-addresses and capabilities for the remote nodes (SCP's). The user can select transfer syntaxes, compression modes and query models for each SCP separately.

- A quality factor which determines the proposed transfer syntax in case that a user has initiated the C-STORE. By convention, 0 means: Only Uncompressed Transfer Syntax(es) are proposed, 100 means: Lossless Transfer Syntax is proposed, and any other value between 1 and 99 means that an JPEG Lossy Transfer Syntax is proposed. One Uncompressed Transfer Syntax will be proposed in any case. This parameter is general for all destination nodes.
- A "compression type supported" which determines the proposed transfer syntax in case that the C-STORE was initiated as a sub-operation of an incoming C-MOVE-RQ. By convention, 0 means: Only Uncompressed Transfer Syntax(es) are proposed, 1 means: Lossless Transfer Syntax is proposed, and 2 means that an JPEG Lossy Transfer Syntax is proposed. One uncompressed transfer syntax will be proposed in any case. This parameter can be set for each configured destination node.

Additional configurable parameters for Storage Commitment are:

When acting as SCU:

- A flag to indicate whether the association will be kept open to receive the response or to close the association and be prepared to receive the response on another association.
- Time-out which defines how long the association of N-ACTION is kept to receive a N-EVENT-REPORT on the same association. The same value is used to wait for a N-EVENT-REPORT on an other association. (default 1 h)

When acting as SCP:

- flag to indicate if an archive system is installed

18.2.2 Print

The *syngo* RT Service/Installation Tool can be used to configure the SCP (DICOM-Printer).

These parameters are mandatory to set:

- AET,
- host-name,
- IP-address and
- Port-number.

These parameters have defaults as per configuration file and can be changed:

- default camera (yes/no),
- pixel size,
- additional or changed film sheet formats (e.g. inch 14x14, inch 14x17, ...),
- list with mapping pixel size to each film sheet format,
- minimal density,
- stored printed film jobs,
- media type,
- film destination.

18.2.3 Modality Worklist

The Service application can be used to set the AETs, port numbers, host names, IP addresses, capabilities and time-outs for the remote nodes (SCPs)

Additional configurable parameters for Modality Worklist Query are:

- Query Waiting time - the time to wait for the C-FIND-RSP after sending the C-FIND-RQ (default 20 sec.)
- Max Query Match Number - the maximum number of entries accepted in one worklist (default is 200)
- Query Interval: the time between two C-FIND-RQ to the Hospital Information system (default is 60 min.)
- Broad Worklist Query behavior (two values are defined):
  - Set the AE Title search attribute to the own AE Title, and the Modality search attribute to “*”.
  - Set the Modality search attribute to the own modality and the AE Title search attribute to “*”.

18.3 Default Parameters

This installation tool also uses some default parameters:

- max PDU size set to 262144 Bytes (256 kB)
- time-out for accepting/rejecting an association request: 60 s
- time-out for responding to an association open/close request: 60 s
- time-out for accepting a message over network: 60 s
- time-out for waiting for data between TCP/IP-packets: 60 s
- The time-outs for waiting for a Service Request/Response message from the remote node are as follows:
- for Storage SCP/SCU: 600 s
- for Storage Commitment SCU:
  time-out for Response to N-ACTION: 600 s
- for Query/Retrieve SCP/SCU: 600 s
- for Print Management SCU:
  - time-out for Response to N-SET-RQ: 240 s
  - time-out for Response to other Requests: 60 s

19. Support of Extended Character Sets

The *syngo* RT DICOM application supports the ISO 8859 Latin 1 (ISO-IR 100) character set.

Also the Japanese language character sets JIS X 0201 (ISO-IR 13 Japanese katakana and ISO-IR 14 Japanese romaji), JIS X 0208 (ISO-IR 87 Japanese kanji) and JIS X 0212 (ISO-IR 159 Supplementary Japanese kanji) are supported.

When there is a mismatch between the SCS tags (0008,0005) and the characters in an IOD received by the system, then the following measures are taken to make the characters DICOM con-form:

- Try to import with ISO_IR 100. If ISO_IR 100 fails, convert each illegal character to a '?'.

Media Storage Conformance Statement

20. Implementation Model

20.1 Application Data Flow Diagram

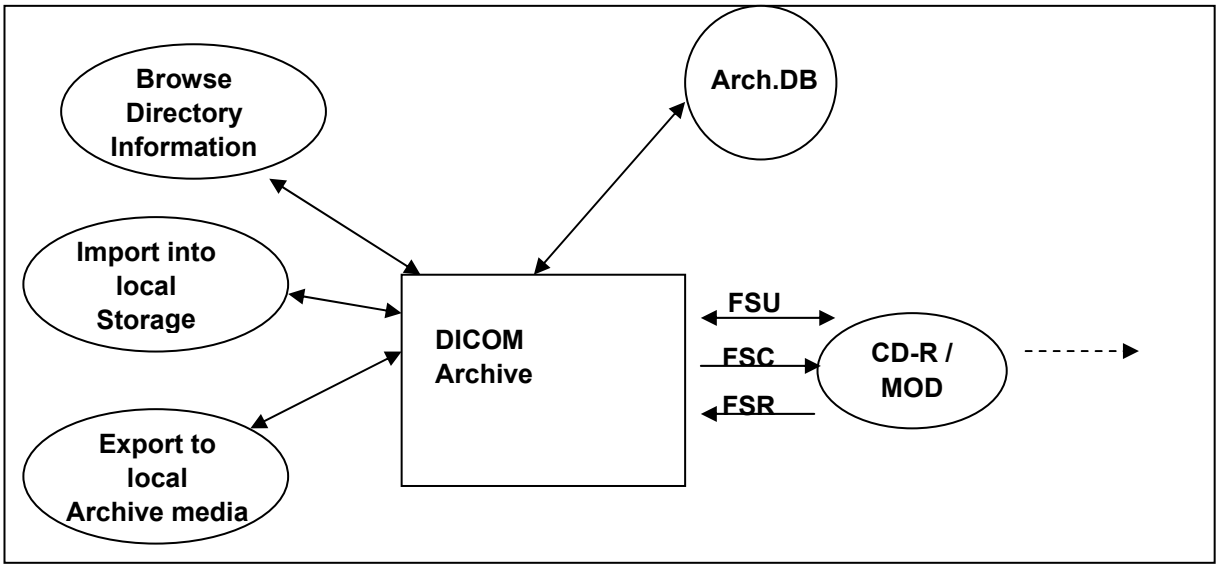


Figure 9: Application Flow Diagram – CDR/MOD

The DICOM Archive application will serve as an interface to the CD-R offline medium device. It serves interfaces to include the offline media directory into the browser and to copy SOP instances to a medium or retrieve SOP Instances from medium into local storage.

The DICOM Archive application will support the 120mm CD-R medium, the 130mm 2.3 GB R/W MOD and the 130mm 4.1 GB R/W MOD and 1.44 MB diskette media.

The FSU role will update new SOP Instances only to media with pre-existing File-sets conforming to the Application Profiles supported.

The contents of the DICOMDIR will be temporarily stored in Archive-Database.

20.2 Functional Definitions of AEs

The *syngo* RT DICOM offline media storage application consists of the DICOM Archive application entity serving all interfaces to access offline media. The DICOM Archive application is capable of

- Creating a new File-set onto an unwritten medium (Export to…).
- Updating an existing File-set by writing new SOP Instances onto the medium (Export to...).
- Importing SOP Instances from the medium onto local storage
- Reading the File-sets DICOMDIR information into temporary database and pass it to display applications

20.3 Sequencing of Real-World Activities

The DICOM Archive application will not perform updates before the Directory information of the DICOMDIR is completely read.

When performing updates, the SOP instances are checked for existence before updating. Duplicate instances will be avoided.

20.4 File Meta Information Options

syngo Suite for Oncology product	Implementation Class UID	Implementation Version Name
syngo RT Therapist	1.3.12.2.1107.5.5.9.20010101	SIEMENS_SWFVD20L

21. AE Specifications

21.1 DICOM Archive Specification

The DICOM Archive provides Standard conformance to Media Storage Service Class (Interchange Option). In addition, augmented conformance is provided to store extra data attributes important for the full feature support of the *syngo* RT product. Details are listed in following table:

Application Profiles Supported	Real-World Activity	Role	SC Option
PRI-SYNGO-CD PRI-SYNGO-MOD23 (option) PRI-SYNGO-MOD41 (option) PRI-SYNGO-DVD-RAM PRI-SYNGO-FD AUG-GEN-CD AUG-CTMR-MOD650 *1 AUG-CTMR-MOD12 *1 AUG-CTMR-MOD23 *1 AUG-CTMR-CD *1 AUG-XA1K-CD *1	Browse Directory Information	FSR	Interchange
	Import into local Storage	FSR	Interchange
	Export to local Archive Media	FSC, FSU	Interchange
STD-GEN-CD STD-CTMR-MOD650 STD-CTMR-MOD12 STD-CTMR-MOD23 STD-CTMR-CD STD-XABC-CD STD-XA1K-CD STD-US-zz-yF-xxxxxx *2 STD-WVFM-GEN-FD	Browse Directory Information	FSR	Interchange
	Import into local Storage	FSR	Interchange

*1 – With no Private SOP Class used, the PRI-*SYNGO*-CD profile definitions are appropriate to describe the augmentation of the related -STD Profiles.

*2 - All combinations of the following values for xx, yF and xxxxxx are supported: yF={SF|MF}, xx={ID|SC|CC}, xxxxxx={FLOP|MOD128| MOD230|MOD540|MOD650|MOD12|MOD23|DVD-RAM|CDR}

On *syngo* based products the Private Extended *syngo* Profile (PRI-*SYNGO*-CD or PRI-*SYNGO*-MOD23 or PRI-*SYNGO*-MOD41 or PRI-*SYNGO*-DVD-RAM or PRI-*SYNGO*-FD) will be preferably used by the system. The General Purpose Interchange Profile (STD-GEN-CD), Ultrasound Profile (STD-US-xxx), CT and MR Image Profile (STD-CTMR-xxx), Waveform Interchange (STD-WVFM-xxx), Basic Cardiac Profile (STD-XABC-CD) and 1024 X-Ray Angiographic Profile (STD-XA1K-CD) will be supported with read capability of the related media.

21.1.1 File Meta Information for the Application Entity

The Source Application Entity Title is set by configuration. See Chapter “Configuration” for details.

21.1.2 Real-World Activities for this Application Entity

21.1.2.1 Real-World Activity: Browse Directory Information

The DICOM Archive application acts as FSR using the interchange option when requested to read the media directory.

The DICOM Archive application will read the DICOMDIR and insert those directory entries that are valid for the application profiles supported into a local database. The database can then be used for browsing media contents.

Note: IconImageSQ is also supported in DICOMDIR. But only those Icon Images with BitsAllocated (0028,0100) equal to 8 and size of 64x64 or 128x128 pixels are imported into database and are visible in the Browser.

21.1.2.1.1 Application Profiles for the RWA: Browse Directory Information

See table in section 3.1 for the Application Profiles listed that invoke this Application Entity for the Browse Directory Information RWA.

21.1.2.2 Real-World Activity: Import into Local Storage

The DICOM Archive application acts as FSR using the interchange option when requested to read SOP Instances from the medium into the local storage.

The SOP Instance selected from the media directory will be copied into the local storage. Only SOP Instances, that are valid for the application profile supported and are listed as supported by the Storage SCP Conformance section (Network DCS, 5.1.3), can be retrieved from media storage. This is due to the fact that the Browse Directory Information will filter all SOP Instances not matching the Application profiles supported.

During operation no “Attribute Value Precedence” is applied to the SOP Instances. Detached Patient Management is not supported (please refer to DICOM Part 11, Media Storage Application Profiles).

For media conforming to the STD-GEN-CD Profile the following SOP classes will be supported as an FSR:

Information Object Definition	SOP Class UID	Transfer Syntax UID
CR Image	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
CT image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
DX Image-For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
DX Image-For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
IOX Image-For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
IOX Image-For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MG Image-For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MG Image-For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
NM Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
PET Image	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Uncompressed

Information Object Definition	SOP Class UID	Transfer Syntax UID
		1.2.840.10008.1.2.1
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Multi-frame Image (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1
CSA Non-Image	1.3.12.2.1107.5.9.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1

21.1.2.2.1 Application Profiles for the RWA: Import into Local Storage

See Table in section 21.1 for the Application Profiles listed that invoke this Application Entity for the Import into Local Storage RWA.

21.1.2.3 Real-World Activity: Export to Local Archive Media

The DICOM Archive application acts as FSU (for media with existing DICOM file-set) or FSC (media not initialized) using the interchange option when requested to copy SOP Instances from the local storage to local Archive Medium.

The DICOM Archive application will receive a list of SOP Instances to be copied to the local archive medium. According to the state of the medium inserted (new medium, Medium with DICOM file-set) the validity of the SOP Instances according to the applicable profile is checked. Only valid SOP Instances are accepted.

When the DICOM Archive application is requested to copy SOP Instances the preferred application profile according configuration (<modify AUG-XA1K-CD> or PRI-*SYNGO*-xxx) will be used to validate and copy the referred SOP Instances. When creating a new file-set no Descriptor File will be allocated and the related ID is not used.

The DICOM Archive application will not close the medium.

21.1.2.3.1 Application Profiles for the RWA: Export to local Archive Media

See Table in section 21.1 for the Application Profiles listed that invoke this Application Entity for the Export to local Archive Media RWA.

22. Augmented and Private Profiles

22.1 Augmented Application Profiles

22.1.1 AUG-GEN-CD

With no private Siemens Non-Images stored onto Medium, the definitions of the PRI-*SYNGO*-CD Profile are applicable to denote the augmentations for the STD-GEN-CD Standard Profile.

Storage of Private Information Objects will only be supported with reference to a Private Application Profile (see next section).

The Siemens non-image is typically used for raw data and 3D private data.

22.1.2 AUG-CTMR-xxxxx

With no private Siemens Non-Images stored onto Medium, the definitions of the PRI-*SYNGO*-CD Profile are applicable to denote the augmentations for the STD-CTMR-MOD650, STD-CTMR-MOD12, STD-CTMR-MOD23 and STD-CTMR-CDR Standard Profiles.

Storage of Private Information Objects will only be supported with reference to a Private Application Profile (see next section).

22.1.3 AUG-XA1K-CD

With no private Siemens Non-Images stored onto Medium, the definitions of the PRI-*SYNGO*-CD Profile are applicable to denote the augmentations for the STD-XA1K-CD Standard Profile.

Storage of Private Information Objects will only be supported with reference to a Private Application Profile (see other section).

22.1.4 *syngo* Private Offline Media Application Profile

This contains a *syngo* specific Application Profile.

Structure of this Application Profile is defined in Part 11 of the 2003 DICOM Standard.

It is needed to describe the requirements for Offline Media Storage of the private IOD (Non-Image IOD).

22.1.5 Class and Profile Identification

This document defines an Application Profile Class for "*syngo* speaking[1]" modalities or applications.

The identifier for this class shall be PRI-*SYNGO*. This class is intended to be used for interchange of extended and private Information Objects via CD-R or re-writeable magneto-optical disk (MOD) offline media between dedicated acquisition or workstation modalities built from common *syngo* architecture.

The specific application profiles in this class are shown in Table below:

Application Profile	Identifier	Description
"syngo speaking" System on CD-R	PRI-SYNGO-CD	Handles interchange of Composite SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD).
"syngo speaking" System on 2.3 GB MOD	PRI-SYNGO-MOD23	Handles interchange of Composite SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD).
"syngo speaking" System on 4.1 GB MOD2	PRI-SYNGO-MOD41	Handles interchange of Composite SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD).
"syngo speaking" System on 4.7 GB DVD RAM	PRI-SYNGO-DVD-RAM	Handles interchange of Composite SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD).

[1] *syngo* is a registered trademark of Siemens AG.

[2] Definition of this profile is done due to approval of DICOM Supplement 62.

Application Profile	Identifier	Description
“syngo speaking” System on Floppy Disk	PRI-SYNGO-FD	Handles interchange of Waveform SOP Instances and privately defined SOP Instances (Siemens Non-Image IOD).

Equipment claiming conformance for this *syngo* Application Profile Class shall make a clear statement on handling of the private defined SOP Instances.

22.1.6 Clinical Context

This application profile facilitates the interchange of original acquired and derived images and private data related to them. Typical media interchange would be from in-lab acquisition equipment to dedicated workstations and archive systems with specific extensions to handle the private data objects (in both directions).

Additionally, images (from MR,CT,US,NM,DX,RF) used to prepare procedures, multi-modality images (e.g. integrated US) and images derived from primary diagnostic images, such as annotations, quantitative analysis images, reference images, screen capture images may be interchanged via this profile.

22.1.6.1 Roles and Service Class Options

This Application Profile uses the Media Storage Service Class defined in PS 3.4 with the Interchange Option.

The Application Entity shall support one or more of the roles of File Set Creator (FSC), File Set Reader (FSR), and File Set Updater (FSU), defined in PS 3.10.

22.1.6.1.1 File Set Creator

The Application Entity acting as a File-Set Creator generates a File Set under the PRI-*SYNGO* Application Profiles.

File Set Creators shall be able to generate the Basic Directory SOP Class in the DICOMDIR file with all the subsidiary Directory Records related to the Image SOP Classes and Private SOP Classes stored in the File Set.

In case of the PRI-*SYNGO*-CD profile, the FSC shall offer the ability to either finalize the disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc).

Note: A multiple volume (a logical volume that can cross multiple physical media) is not supported by this Application Profile Class. If a set of Files, e.g., a Study, cannot be written entirely on one CD-R, the FSC will create multiple independent DICOM File-Set such that each File-Set can reside on a single CD-R medium controlled by its individual DICOMDIR file. The user of the FSC can opt to use written labels on the discs to reflect that there is more than one disc for this set of files (e.g., a Study).

22.1.6.1.2 File Set Reader

The role of the File Set Reader shall be used by Application Entities which receive the transferred File Set.

File Set Readers shall be able to read all the defined SOP Instances files defined for the specific Application Profiles to which a conformance claim is made, using all the defined Transfer Syntaxes.

22.1.6.1.3 File Set Updater

The role of the File Set Updater shall be used by Application Entities, which receive a transferred File Set and update it by the addition of processed information.

File Set Updaters shall be able to read and update the DICOMDIR file. File-Set Updaters do not have to read the image/private information objects. File-Set Updaters shall be able to generate any of the SOP

Instances files defined for the specific Application Profiles to which a conformance claim is made, and to read and update the DICOMDIR file.

In case of the PRI-*SYNGO*-CD profile, the FSU shall offer the ability to either finalize a disc at the completion of the most recent write session (no additional information can be subsequently added to the disc) or to allow multi-session (additional information may be subsequently added to the disc).

Note (for CD-R): If the disc has not been finalized, the File-Set Updater will be able to update information assuming there is enough space on the disc to write a new DICOMDIR file, the information, and the fundamental CD-R control structures. CD-R control structures are the structures that inherent to the CD-R standards; see PS 3.12

22.1.7 PRI-*SYNGO* Profiles

22.1.7.1 SOP Classes and Transfer Syntaxes

These Application Profiles are based on the Media Storage Service Class with the Interchange Option. In the table below, Transfer Syntax UID “RLE Lossless“ applies only for decompression.

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR	FSU
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	M
CR Image	1.2.840.10008.5.1.4.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
CR Image	1.2.840.10008.5.1.4.1.1.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
CR Image	1.2.840.10008.5.1.4.1.1.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
CR Image	1.2.840.10008.5.1.4.1.1.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
CR Image	1.2.840.10008.5.1.4.1.1.1	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
CT image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
CT Image	1.2.840.10008.5.1.4.1.1.2	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
CT Image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
CT Image	1.2.840.10008.5.1.4.1.1.2	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
CT Image	1.2.840.10008.5.1.4.1.1.2	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR	FSU
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
DX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
DX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
MG Image – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
MG Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.2	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
IOX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
IOX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
IOX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR	FSU
IOX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
IOX Image – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
IOX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
IOX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
IOX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
IOX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
IOX Image – For Presentation	1.2.840.10008.5.1.4.1.1.1.3	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
MR Image	1.2.840.10008.5.1.4.1.1.4	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
MR Image	1.2.840.10008.5.1.4.1.1.4	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
MR Image	1.2.840.10008.5.1.4.1.1.4	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
NM Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
NM Image	1.2.840.10008.5.1.4.1.1.20	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
NM Image	1.2.840.10008.5.1.4.1.1.20	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
NM Image	1.2.840.10008.5.1.4.1.1.20	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
NM Image	1.2.840.10008.5.1.4.1.1.20	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
PET Image	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
PET Image	1.2.840.10008.5.1.4.1.1.128	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
PET Image	1.2.840.10008.5.1.4.1.1.128	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR	FSU
PET Image	1.2.840.10008.5.1.4.1.1.128	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
PET Image	1.2.840.10008.5.1.4.1.1.128	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
RT Dose	1.2.840.10008.5.1.4.1.1.481.2	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
RT Image	1.2.840.10008.5.1.4.1.1.481.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
RT Image	1.2.840.10008.5.1.4.1.1.481.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Image	1.2.840.10008.5.1.4.1.1.481.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
RT Image	1.2.840.10008.5.1.4.1.1.481.1	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
RT Plan	1.2.840.10008.5.1.4.1.1.481.5	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
RT Structure Set	1.2.840.10008.5.1.4.1.1.481.3	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
Secondary Capture Image	1.2.840.10008.5.1.4.1.1.7	RLE Lossless 1.2.840.10008.1.2.5	O	O	O
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	-	M	-
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	M	-

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR	FSU
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	-	M	-
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	-	M	-
Ultrasound Image (retired)	1.2.840.10008.5.1.4.1.1.6	RLE Lossless 1.2.840.10008.1.2.5	-	M	-
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	M	O
Ultrasound Image	1.2.840.10008.5.1.4.1.1.6.1	RLE Lossless 1.2.840.10008.1.2.5	O	M	O
Ultrasound Multi-frame Image (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	-	M	-
Ultrasound Multi-frame Image (retired)	1.2.840.10008.5.1.4.1.1.3	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	-	M	-
Ultrasound Multi-frame Image (retired)	1.2.840.10008.5.1.4.1.1.3	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	-	M	-
Ultrasound Multi-frame Image (retired)	1.2.840.10008.5.1.4.1.1.3	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	-	M	-
Ultrasound Multi-frame Image (retired)	1.2.840.10008.5.1.4.1.1.3	RLE Lossless 1.2.840.10008.1.2.5	-	M	-
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	O	M	O
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	M	O
Ultrasound Multi-frame Image	1.2.840.10008.5.1.4.1.1.3.1	RLE Lossless 1.2.840.10008.1.2.5	O	M	O
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	M	M	O
X-Ray Angiographic	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Little Endian Uncompressed	O	M	O

Information Object Definition	SOP Class UID	Transfer Syntax UID	FSC	FSR	FSU
Image		1.2.840.10008.1.2.1			
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
X-Ray Angiographic Image	1.2.840.10008.5.1.4.1.1.12.1	RLE Lossless 1.2.840.10008.1.2.5	O	M	O
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	JPEG Lossless Process 14 (selection value 1) 1.2.840.10008.1.2.4.70	M	M	O
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	O	M	O
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	JPEG Lossy (baseline or extended) 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.4.51	O	O	O
X-Ray Radiofluoroscopic Image	1.2.840.10008.5.1.4.1.1.12.2	RLE Lossless 1.2.840.10008.1.2.5	O	M	O
Waveform Storage SOP Classes	1.2.840.10008.5.1.4.1.1.9.1.1 1.2.840.10008.5.1.4.1.1.9.1.2 1.2.840.10008.5.1.4.1.1.9.1.3 1.2.840.10008.5.1.4.1.1.9.2.1 1.2.840.10008.5.1.4.1.1.9.3.1 1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	M	M	O
Waveform Storage SOP Classes	1.2.840.10008.5.1.4.1.1.9.1.1 1.2.840.10008.5.1.4.1.1.9.1.2 1.2.840.10008.5.1.4.1.1.9.1.3 1.2.840.10008.5.1.4.1.1.9.2.1 1.2.840.10008.5.1.4.1.1.9.3.1 1.2.840.10008.5.1.4.1.1.9.4.1	Explicit VR Big Endian Uncompressed 1.2.840.10008.1.2.2	O	M	O
CSA Non-Image	1.3.12.2.1107.5.9.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	O	M	O
Detached Patient Management	1.2.840.10008.3.1.2.1.1	Explicit VR Little Endian Uncompressed 1.2.840.10008.1.2.1	O	see DCS	O

O – Optional

M - Mandatory

22.1.7.2 Physical Media and Formats

The PRI-*SYNGO*-CD Profile requires the 120mm CD-R physical media with the ISO/IEC 9660 Media Format, as defined in PS3.12.

The PRI-*SYNGO*-MOD23 Profile requires the 130mm 2.3 GB R/W MOD physical medium with the PCDOS Media Format, as defined in PS3.12.

The PRI-*SYNGO*-MOD41 Profile requires the 130mm 4.1 GB R/W MOD physical medium with the PCDOS Media Format, as defined in PS 3.12.

The PRI-*SYNGO*-DVD-RAM Profile requires the 120mm DVD-RAM physical media according to “DVD Specifications for Rewritable Disc (DVD-RAM 4.7GB): Part 1 – Physical Specifications Version 2.0” and “Part 2- File System Specifications Version 2”.

The PRI-*SYNGO*-FD Profile requires the 1.44 MB diskette physical medium with the PCDOS Media Format, as defined in PS3.12.

22.1.7.3 Directory Information in DICOMDIR

Conforming Application Entities shall include in the DICOMDIR File the Basic Directory IOD containing Directory Records at the Patient and subsidiary levels appropriate to the SOP Classes in the File-set. All DICOM files in the File-set incorporating SOP Instances defined for the specific Application profile shall be referenced by Directory Records.

Note: DICOMDIRs with no directory information are not allowed by this Application Profile Privately defined IODs will be referenced by “PRIVATE” Directory Records.

22.1.7.3.1 Basic Directory IOD Specialization

This Application Profile makes use of optional attributes of the Basic Directory IOD to support recognition of Patient’s Storage Service request results in spanning multiple volumes (file sets). Therefore the File Set Descriptor File can be used and is then referenced by optional Basic Directory IOD attributes. If existent, the specified Descriptor File may be used by FSR applications. Any FSU, FSC shall make a clear Statement if the Descriptor File mechanism is used according to the specialization defined in this Application Profile.

The Descriptor Files shall have the following contents:

One single Line without any control-characters and according to the Basic Character-Set having the following defined text:

“MULTIVOLUME: xx of yy”

xx, yy are replaced by the actual Number of the volume (xx) and the Total Number of Volumes in the set (yy).

If used, the Descriptor File shall have the File ID “README” and reside in same directory level as the DICOMDIR. It is referenced by the attribute [0004,1141] File-set Descriptor File ID having the defined content of “README”.

22.1.7.3.2 Additional Keys

File-set Creators and Updaters are required to generate the mandatory elements specified in PS 3.3, Annex F of the DICOM Standard. Table below:PRI-*SYNGO*-CD Additional DICOMDIR Keys specifies the additional associated keys. At each directory record level other additional data elements can be added, but it is not required that File Set Readers be able to use them as keys. Refer to the Basic Directory IOD in PS 3.3.

Key Attribute	Tag	Directory Record Level	Type	Notes
Date of Birth	(0010,0030)	PATIENT	2C	required, if present in SOP Instance
Patient’s Sex	(0010,0040)	PATIENT	2C	required, if present in SOP Instance
Series Date	(0008,0021)	SERIES	3	
Series Time	(0008,0031)	SERIES	3	
Institute Name	(0008,0080)	SERIES	2C	required, if present in SOP Instance
Institution Address	(0008,0081)	SERIES	2C	required, if present in SOP Instance
Series Description	(0008,103E)	SERIES	3	
Performing Physician’s Name	(0008,1050)	SERIES	2C	required, if present in SOP Instance
Image Type	(0008,0008)	IMAGE	1C	required, if present in SOP

Key Attribute	Tag	Directory Record Level	Type	Notes
				Instance
SOP Class UID	(0008,0016)	IMAGE	3	
SOP Instance UID	(0008,0018)	IMAGE	3	
Image Date	(0008,0023)	IMAGE	3	
Image Time	(0008,0033)	IMAGE	3	
Referenced Image Sequence	(0008,1140)	IMAGE	1C	required, if present in SOP Instance
> Referenced SOP Class UID	(0008,1150)			
> Referenced SOP Instance UID	(0008,1155)			
Image Position (Patient)	(0020,0032)	IMAGE	2C	required, if present in SOP Instance
Image Orientation (Patient)	(0020,0037)	IMAGE	2C	required, if present in SOP Instance
Frame of Reference UID	(0020,0052)	IMAGE	2C	required, if present in SOP Instance
Rows	(0028,0010)	IMAGE	3	
Columns	(0028,0011)	IMAGE	3	
Pixel Spacing	(0028,0030)	IMAGE	1C	required, if present in SOP Instance
Calibration Image	(0050,0004)	IMAGE	2C	required, if present in SOP Instance
Icon Image Sequence	(0088,0200)	IMAGE	3	required for Image SOP Classes
> Samples per Pixel	(0028,0002)			1
> Photometric Interpretation	(0028,0004)			MONOCHROME2
> Rows	(0028,0010)			128 for XA, 64 for others
> Columns	(0028,0011)			128 for XA, 64 for others
> Bits Allocated	(0028,0100)			8
> Bits Stored	(0028,0101)			8
> High Bit	(0028,0102)			7
> Pixel Representation	(0028,0103)			0
> Pixel Data	(7FE0,0010)			Icon Image
Curve Number	(0020,0024)	CURVE	1C	required, if present in SOP Instance

22.1.7.3.3 Private Directory Record Keys

Private Directory Records are supported by this Application Profile Class at the following Level - IMAGE. The PRIVATE Directory Records will have required elements in addition to the mandatory elements specified in PS 3.3.

The following table will list the additional required keys for PRIVATE Directory Records:

Key Attribute	Tag	Directory Record Level	Type	Notes
Private Record UID	(0004,1432)	PRIVATE	1	See Conformance Statement
SOP Class UID	(0008,0016)	PRIVATE	1C	required, if present in SOP Instance
SOP Instance UID	(0008,0018)	PRIVATE	1C	required, if present in SOP Instance
Image Type	(0008,0008)	PRIVATE	3	
Acquisition Date	(0008,0022)	PRIVATE	3	
Acquisition Time	(0008,0032)	PRIVATE	3	
Acquisition Number	(0020,0012)	PRIVATE	3	
CSA Data Type	(0029,xx08)	PRIVATE	1	private owner code = SIEMENS CSA NON-IMAGE

Key Attribute	Tag	Directory Record Level	Type	Notes
CSA Data Version	(0029,xx09)	PRIVATE	3	private owner code = SIEMENS CSA NON-IMAGE

22.1.7.3.4 Icon Images

Directory Records of type SERIES or IMAGE may include Icon Images. The Icon Image pixel data shall be as specified in PS 3.3 “Icon Image Key Definition”, and restricted such, that Bits Allocated (0028,0100) and Bits Stored (0028,0101) shall be equal 8, and Rows (0028,0010) and Columns (0028,0011) shall be equal to 128 for XA Images and 64 for all other Images. The Photometric Interpretation (0028,0004) shall always be restricted to “MONOCHROME2”.

PRIVATE Directory Records will not contain Icon Image information.

22.1.7.4 Other Parameters

This section defines other parameters common to all specific Application Profiles in the PRI-*SYNGO* class which need to be specified in order to ensure interoperable media interchange.

22.1.7.4.1 Multi-Frame JPEG Format

The JPEG encoding of pixel data shall use Interchange Format (with table specification) for all frames.

22.1.7.4.2 Attribute Value Precedence

The values of attributes contained in a Detached Patient Management SOP Instance referenced by a DICOMDIR PATIENT Directory Record shall take precedence over the values of those attributes contained in the SOP Instance referenced by a subsidiary Directory Record. The DICOMDIR Directory Records shall have key attribute values in accordance with this precedence.

Note: This allows patient identification and demographic information to be updated without changing the composite Image IOD files. The DICOMDIR file thus is critical in establishing the link between the updated information and the image. As an example, at the time an Image file was written, the patient’s name therein was incorrect, or inconsistent with the Hospital Information System records. Subsequently, a Detached Patient Management file with the corrected name is added to the file-set. The FSR should use the name from the Patient File rather than in the Image File.

23. Extensions, Specialization and Privatization of SOP Classes and Transfer Syntaxes

The SOP Classes listed refer in majority to those created by the equipment to which this conformance Statement is related to. For SOP classes not listed in this section, please refer to the Storage section of the DICOM Conformance Statement of the product. This will include all SOP Instances that can be received and displayed and therefore will be included into offline media storage even though these SOP Instances are not created by the equipment serving the Media Storage Service.

23.1 SOP Specific Conformance Statement for Basic Directory

23.1.1 Extension, Specialization for SIEMENS Non-Image Objects

According to the PRI-*SYNGO* Application Profile Class the usage of the Private Creator UIDs and further optional keys for the Directory Records referring to SIEMENS Non-Image Objects are listed in the following tables.

Attribute	Tag	Value used
Private Record UID	(0004,1432)	1.3.12.2.1107.5.9.1
SOP Class UID	(0008,0016)	1.3.12.2.1107.5.9.1

For those “Non-Images” no Icon Image Sequence will be generated.

24. Configuration

24.1 AE Title Mapping

24.1.1 DICOM Media Storage AE Title

The DICOM Storage application provides the application entity title:

CsaImageManager

25. Support of Extended Character Sets

The DICOM Archive application supports the ISO 8859 Latin 1 (ISO-IR 100) character set.

Also the Japanese language character sets JIS X 0201 (ISO-IR 13 Japanese katakana and ISO-IR 14 Japanese romaji), JIS X 0208 (ISO-IR 87 Japanese kanji) and JIS X 0212 (IOS-IR 159 Supplementary Japanese kanji) are supported.

When there is a mismatch between the SCS tags (0008,0005) and the characters in an IOD received by the system, then the following measures are taken to make the characters DICOM conform:

- Try to import with ISO_IR 100. If ISO_IR 100 fails, convert each illegal character to a ’?’.ANNEX

Appendix

A.1 SIEMENS Private Non-Image IOD

For encoding binary data-streams not representing image data, Siemens has created a private “Non-Image IOD” according to the rules governed by the DICOM Standard. The following section will roll-out the definition of this Private IOD. It can be communicated with Network Storage Service and Offline Media Storage Services.

The Siemens “Non-Image IOD” is identified by a private Non-Image Storage SOP Class UID of

„1.3.12.2.1107.5.9.1“

A.1.1 Siemens Non-Image IOD – E-R Model

The E-R model in A.1.2 depicts those components of the DICOM Information Model which directly refer to the Siemens Non-Image IOD. The Frame of Reference IE, Overlay IE, Modality Lookup-Table IE, VOI Lookup-Table IE and Curve IE are not components of the Siemens Non-Image IOD.

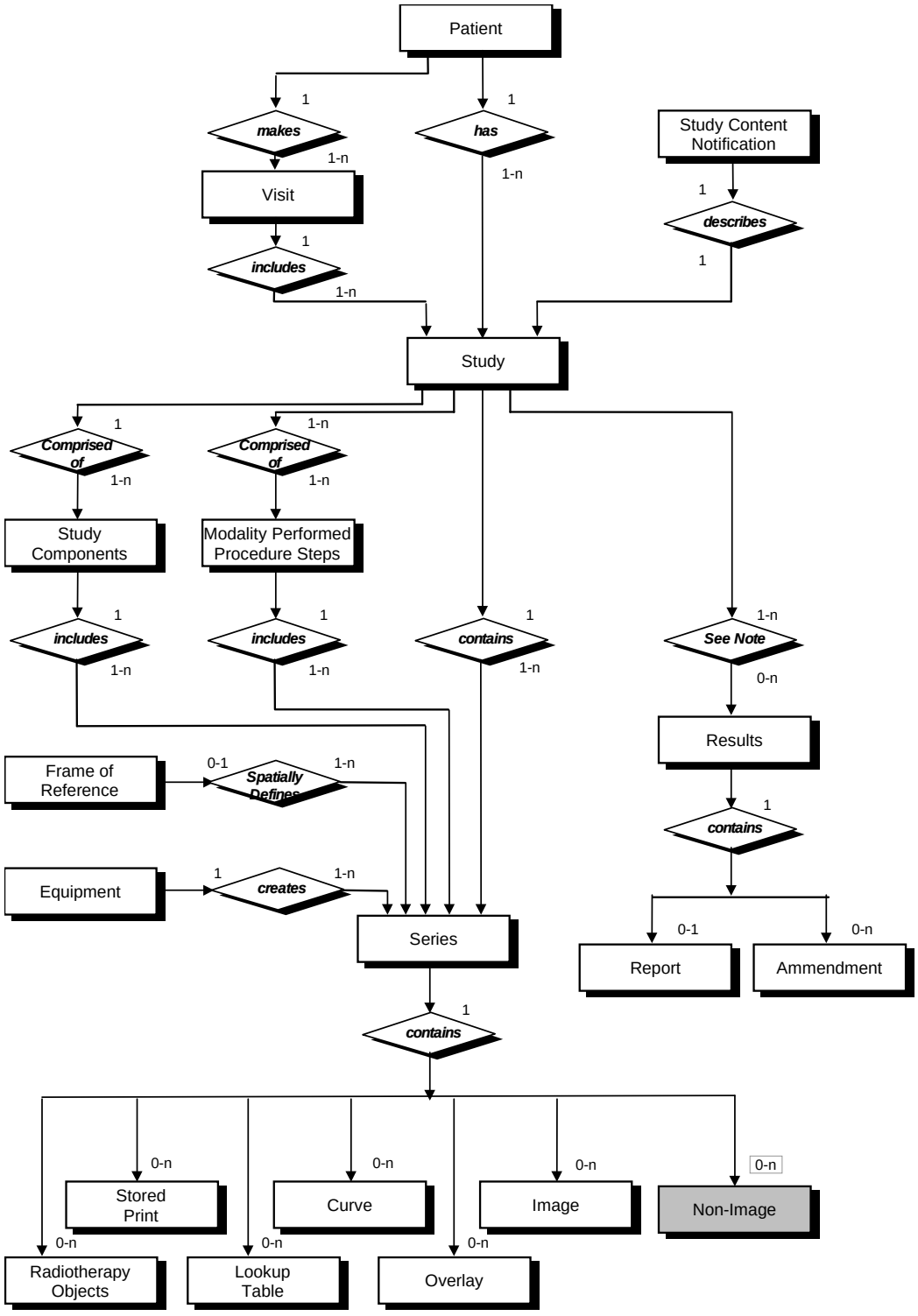


Figure 10: CsaNonImage IOD ER Model

A.1.2 Siemens Non-Image IOD - Module Table

IE	Module	Reference	Usage
Patient	Patient	[1] PS3.3 C.7.1.1	M
Study	General Study	[1] PS3.3 C.7.2.1	M
	Patient Study	[1] PS3.3 C.7.2.2	U
Series	General Series	[1] PS3.3 C.7.3.1	M
Equipment	General Equipment	[1] PS3.3 C.7.5.1	U
CSA	CSA Image Header	A.2.1	U
	CSA Series Header	A.2.2	U
	MEDCOM Header	A.2.3	U
	CSA Non-Image	A.1.3.1	M
	SOP Common	[1] PS3.3 C.12.1	M

A.1.3 Siemens Non-Image IOD - Modules

A.1.3.1 Siemens Non-Image Module

The table in this section contains private IOD Attributes that describe CSA Non-Images.

Attribute Name	Tag	Owner	Type	Notes
Image Type	(0008,0008)	-	3	Image identification characteristics.
Acquisition Date	(0008,0022)	-	3	The date the acquisition of data that resulted in this data set started.
Acquisition Time	(0008,0032)	-	3	The time the acquisition of data that resulted in this data set started.
Conversion Type	(0008,0064)	-	3	Describes the kind of image conversion. Defined Terms: DV = Digitized Video, DI = Digital Interface, DF = Digitized Film, WSD = Workstation.
Referenced Image Sequence	(0008,1140)	-	3	A sequence which provides reference to a set of Image SOP Class/Instance identifying other images significantly related to this data set. Encoded as sequence of items: (0008,1150) and (0008,1155).
Derivation Description	(0008,2111)	-	3	A text description of how this data set was derived.
Source Image Sequence	(0008,2112)	-	3	A Sequence which identifies the set of Image SOP Class/Instance pairs of the Images which were used to derive this data set. Zero or more Items may be included in this Sequence. Encoded as sequence of items: (0008,1150) and (0008,1155).
Patient Position	(0018,5100)	-	3	Patient position descriptor relative to the equipment.
Acquisition Number	(0020,0012)	-	3	A number identifying the single continuous gathering of data over a period of time which resulted in this data set.
Image Number	(0020,0013)	-	3	A number that identifies this data set.
Frame of Reference UID	(0020,0052)	-	3	Uniquely identifies the frame of reference for a Series.

Attribute Name	Tag	Owner	Type	Notes
Image Comments	(0020,4000)	-	3	User-defined comments about the image.
Quality Control Image	(0028,0300)	-	3	Indicates whether or not this image is a quality control or phantom image. If this Attribute is absent, then the image may or may not be a quality control or phantom image. Enumerated Values: YES, NO.
Burned in Annotation	(0028,0301)	-	3	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired. If this Attribute is absent, then the image may or may not contain burned in annotation. Enumerated Values: YES, NO.
Lossy Image Compression	(0028,2110)	-	3	Specifies whether an Image has undergone lossy compression. Enumerated Values: 00 = Image has NOT been subjected to lossy compression, 01 = Image has been subjected to lossy compression.
Lossy Image Compression Ratio	(0028,2112)	-	3	Describes the approximate lossy compression ratio(s) that have been applied to this image. May be multi valued if successive lossy compression steps have been applied.
CSA Data Type	(0029,xx08)	SIEMENS CSA NON-IMAGE	1	CSA Data identification characteristics. Defined Terms: BSR REPORT = Study Report Data 3D EDITOR 3D FLY PATH = Fly Through Data 3D FLY VRT = Fly Through Data 3D FUSION MATRIX = Fusion Data RAW DATA NUM 4 = NUMARIS/ Raw Data RAW DATA SOM 5 = SOMARIS/ Raw Data RT3D CONFIG = InSpaceIS Data SPEC NUM 4 = NUMARIS/4 Spectroscopy
CSA Data Version	(0029,xx09)	SIEMENS CSA NON-IMAGE	3	Version of CSA Data Info (0029,xx10) format and CSA Non-Image Data (7FE1,xx10) format.
CSA Data Info	(0029,xx10)	SIEMENS CSA NON-IMAGE	3	Information to describe the CSA Data (7FE1,xx10).
CSA Data	(7FE1,xx10)	SIEMENS CSA NON-IMAGE	2	Binary data as byte stream.

A.2 Siemens Standard Extended Modules

IE	Module	Reference	Usage	Notes
Image	CSA Image Header	A.2.1	U	private GG information
	CSA Series Header	A.2.2	U	
	MEDCOM Header	A.2.3	U	private syngo information
	MEDCOM OOG	A.2.4	U	if object graphics is attached to image

A.2.1 Siemens Image Header Module

The table in this section contains private IOD Attributes that describe the CSA Image Header:

Attribute Name	Tag	Owner	Type	Notes
CSA Image Header Type	(0029,xx08)	SIEMENS CSA HEADER	1	CSA Image Header identification characteristics. Defined Terms: NUM 4 = NUMARIS/4 SOM 5 = SOMARIS/5
CSA Image Header Version	(0029,xx09)	SIEMENS CSA HEADER	3	Version of CSA Image Header Info (0029,xx10) format.
CSA Image Header Info	(0029,xx10)	SIEMENS CSA HEADER	3	Manufacturer model dependent information.

A.2.2 Siemens Series Header Module

The table in this section contains private IOD Attributes that describe the CSA Series Header:

Attribute Name	Tag	Owner	Type	Notes
CSA Series Header Type	(0029,xx18)	SIEMENS CSA HEADER	1	CSA Series Header identification characteristics. Defined Terms: NUM 4 = NUMARIS/4
CSA Series Header Version	(0029,xx19)	SIEMENS CSA HEADER	3	Version of CSA Series Header Info (0029,xx20) format.
CSA Series Header Info	(0029,xx20)	SIEMENS CSA HEADER	3	Manufacturer model dependent information.

A.2.3 MEDCOM Header Module

The table in this section contains private IOD Attributes that describe MEDCOM Header:

Attribute Name	Tag	Owner	Type	Notes
MedCom Header Type	(0029,xx08)	SIEMENS MEDCOM HEADER	1C	MedCom Header identification characteristics. Defined Terms: MEDCOM 1 (Required if MedCom Header Info (0029,xx10) present.)
MedCom Header Version	(0029,xx09)	SIEMENS MEDCOM HEADER	2C	Version of MedCom Header Info (0029,xx10) format. (Required if MEDCOM Header Info (0029,xx10) present.)

Attribute Name	Tag	Owner	Type	Notes
MedCom Header Info	(0029,xx10)	SIEMENS MEDCOM HEADER	3	Manufacturer model dependent information. The value of the attribute MedCom Header Info (0029,xx10) can be build up in each user defined format.
MedCom History Information	(0029,xx20)	SIEMENS MEDCOM HEADER	3	MedCom defined Patient Registration history information. See A.2.3.1.
PMTF Information 1	(0029,xx31)	SIEMENS MEDCOM HEADER	3	Transformation Information
PMTF Information 2	(0029,xx32)	SIEMENS MEDCOM HEADER	3	Transformation Information
PMTF Information 3	(0029,xx33)	SIEMENS MEDCOM HEADER	3	Transformation Information
PMTF Information 4	(0029,xx34)	SIEMENS MEDCOM HEADER	3	Transformation Information
PMTF Information 5	(0029,xx35)	SIEMENS MEDCOM HEADER	3	Transformation Information
Application Header Sequence	(0029,xx40)	SIEMENS MEDCOM HEADER	3	Sequence of Application Header items. Zero or more items are possible.
>Application Header Type	(0029,xx41)	SIEMENS MEDCOM HEADER	1C	Application Header identification characteristics. Required, if Sequence is sent.
>Application Header ID	(0029,xx42)	SIEMENS MEDCOM HEADER	3	Identification of an application header
>Application Header Version	(0029,xx43)	SIEMENS MEDCOM HEADER	3	Version of CSA Series Header Info (0029,xx44) format.
>Application Header Info	(0029,xx44)	SIEMENS MEDCOM HEADER	3	Application dependent information.
Workflow Control Flags	(0029,xx50)	SIEMENS MEDCOM HEADER	3	Eight free definable flags.
Archive Management Flag Keep Online	(0029,xx51)	SIEMENS MEDCOM HEADER	3	Flag to control remote archive manage-ment system to keep the image always online (also when already archived). Enumerated Values: 00 = remote control not required 01 = keep image online
Archive Management Flag Do Not Archive	(0029,xx52)	SIEMENS MEDCOM HEADER	3	Flag to control remote archive manage-ment system not to archive the related image. Enumerated Values: 00 = remote control not required 01 = don't archive image

Attribute Name	Tag	Owner	Type	Notes
Image Location Status	(0029,xx53)	SIEMENS MEDCOM HEADER	3	Image location status to control retriev-ing. Defined Terms: ONLINE = retrieving has to be done as usual, NEARLINE = move request to SCP and delay according to value of Estimated Retrieve Time (0029,xx54), OFFLINE = invoking a retrieve operation initiates an operator request, INVALID = invoking a retrieve operation would always result in an error.
Estimated Retrieve Time	(0029,xx54)	SIEMENS MEDCOM HEADER	3	Estimated retrieve time in seconds. A value less then zero (< 0) indicates location is OFFLINE or INVALID.
Data Size of Retrieved Images	(0029,xx55)	SIEMENS MEDCOM HEADER	3	Data size of images in MByte.
Siemens Link Sequence	(0029,xx70)	SIEMENS MEDCOM HEADER	3	Sequence of link items. Each item identify the location of one missing tag. One or more items can be included in this sequence.
Referenced Tag	(0029,xx71)	SIEMENS MEDCOM HEADER	1	The referenced tag. The value of this tag is in the Child Data Object (CDO). Currently it is always Pixel Data (7FE0,0010).
Referenced Tag Type	(0029,xx72)	SIEMENS MEDCOM HEADER	1	The Value Representation (type) of the missing tag (e.g. OW). Enumerated values are all DICOM defined Value Representations.
Referenced Value Length	(0029,xx73)	SIEMENS MEDCOM HEADER	1	The length of the referenced tag value in bytes.
Referenced Object Device Type	(0029,xx74)	SIEMENS MEDCOM HEADER	1	The Device Type that stores the Child Data Object (CDO) with the referenced tag value. Currently it should be "SHMEM". In future, "SDM", "LOID" or "FILE" are also imaginable. Defined Terms are SHMEM = Shared Memory SDM = Series Data Management LOID = Database FILE
Referenced Object Device Location	(0029,xx75)	SIEMENS MEDCOM HEADER	2	The Location of the device that stores the Child Data Object (CDO) with the referenced tag value. For the “SHMEM” case, it is the shared memory directory. Can be empty, then the default directory will be taken. In future, for "SDM" this will be the SDM_ID, for FILE it will be the directory name and for "LOID" it will be the database name.

Attribute Name	Tag	Owner	Type	Notes
Referenced Object ID	(0029,xx76)	SIEMENS MEDCOM HEADER	1	The ID of the object that contains the Child Data Object (CDO) with the referenced tag value. In case of “SHMEM” it is the shared memory ID. In future, for “SDM” this will be a Sirius OID, for “FILE” the file name, for “DB” the LOID.
Series Work Flow Status	(0029,xx60)	SIEMENS MEDCOM HEADER2	3	syngo Patient Browser specific flags used for clinical work: • com = completed • rea = read • ver = verified

A.2.3.1 MEDCOM History Information

The value of the attribute MEDCOM History Information (0029,xx20) is defined in the following way:

Part	Name	Type	Bytes	Notes
Header	Identifier	string	32	Always “CSA HISTORY”
	Version	string	32	e.g. “V1.10”
n Items	Class Name	string	64	
	Modification String	string	1024	

A.2.4 MEDCOM OOG Module

The table in this section contains private IOD Attributes that describe MEDCOM Object Oriented Graphics (OOG). This module is used whenever object graphics is drawn on the image and need to be stored as graphic object properties. Given the condition that the module contents was not removed by other modalities, the graphic objects remain re-animatable if such an image was transferred and is then retrieved back.

Attribute Name	Tag	Owner	Type	Notes
MedCom OOG Type	(0029,xx08)	SIEMENS MEDCOM OOG	1	MEDCOM Object Oriented Graphics (OOG) identification characteristics. Defined Terms: MEDCOM OOG 1 MEDCOM OOG 2
MedCom OOG Version	(0029,xx09)	SIEMENS MEDCOM OOG	3	Version of MEDCOM OOG Info (0029,xx10) format.
MedCom OOG Info	(0029,xx10)	SIEMENS MEDCOM OOG	3	MEDCOM Object Oriented Graphics (OOG) data.

The graphics objects are also fully drawn in the Image Overlay Plane for compatibility with other products, which do not support the MedCom OOG module. Any system not supporting the MedCom OOG module shall remove the OOG module and it’s contents when modifying the image overlay plane content.

A.2.5 *syngo* Report Data

The module contains private IOD Attributes that describe *syngo* reports. This module is used when *syngo* report data are added to DICOM SR and DICOM SC objects.

Attribute Name	Tag	Owner	Type	Notes
syngo Report Type	(0029,xx08)	SIEMENS CSA REPORT	1	syngo report characteristics, e.g. report creating application. Defined Terms: CT_LUNGCARE MR_ARGUS This attribute value will be used to identify the corresponding application during generic extension dll management. A restricted character set is used: only A-Z and underscore are supported.
syngo Report Version	(0029,xx09)	SIEMENS CSA REPORT	3	Version of syngo Report Data (0029,xx10) format.
syngo Report Data	(0029,xx10)	SIEMENS CSA ENVELOPE	3	A representation of DICOM SR Attribute Content Sequence (0040,A730). This includes the document relationship and document content. This data will typically be represented using an XML encoding according to a Siemens private scheme.
syngo Report Presentation	(0029,xx11)	SIEMENS CSA ENVELOPE	3	A representation of the recommended presentation for the syngo Report Data (0029,xx10). This presentation will typically be encoded in XSLT.
SR Variant	(0029,xx15)	SIEMENS CSA REPORT		DICOM SR variant. Enumerated Values: 0 =Basic Text SR (1.2.840.10008.5.1.4.1.1.88.11) 1 = Enhanced SR (1.2.840.10008.5.1.4.1.1.88.22) 2 = Comprehensive SR (1.2.840.10008.5.1.4.1.1.88.33) 3 =Mammography CAD SR (1.2.840.10008.5.1.4.1.1.88.50) 4 = Key Object Selection Document (1.2.840.10008.5.1.4.1.1.88.59)
SC SOP Instance UID	(0029,xx17)	SIEMENS CSA REPORT	3	DICOM SOP Instance UID of syngo based SC Image representing the syngo report object. This UID will be used to identify the Resulting SC object after SR to SC conversion.

A.2.6 *syngo* Report Info

The module *syngo* Report Info contains all DICOM SR attributes exept the Contents Sequence 0040,A730). This module is only used during SR to SC conversion.

A.3 Registry of DICOM Data Elements

Tag	Private Owner Code	Name	VR	VM
(0029,xx08)	SIEMENS CSA NON-IMAGE	CSA Data Type	CS	1
(0029,xx09)	SIEMENS CSA NON-IMAGE	CSA Data Version	LO	1
(0029,xx10)	SIEMENS CSA NON-IMAGE	CSA Data Info	OB	1
(0029,xx08)	SIEMENS CSA HEADER	CSA Image Header Type	CS	1
(0029,xx09)	SIEMENS CSA HEADER	CSA Image Header Version	LO	1
(0029,xx10)	SIEMENS CSA HEADER	CSA Image Header Info	OB	1
(0029,xx18)	SIEMENS CSA HEADER	CSA Series Header Type	CS	1
(0029,xx19)	SIEMENS CSA HEADER	CSA Series Header Version	LO	1
(0029,xx20)	SIEMENS CSA HEADER	CSA Series Header Info	OB	1
(0029,xx08)	SIEMENS CSA REPORT	syngo Report Type	CS	1
(0029,xx09)	SIEMENS CSA REPORT	syngo Report	LO	1
(0029,xx15)	SIEMENS CSA REPORT	SR Variant	US	1
(0029,xx17)	SIEMENS CSA REPORT	SC SOP Instance UID	UI	1
(0029,xx10)	SIEMENS CSA ENVELOPE	syngo Report Data	OB	1
(0029,xx11)	SIEMENS CSA ENVELOPE	syngo Report Presentation	OB	1
(0029,xx08)	SIEMENS MEDCOM HEADER	MedCom Header Type	CS	1
(0029,xx09)	SIEMENS MEDCOM HEADER	MedCom Header Version	LO	1
(0029,xx10)	SIEMENS MEDCOM HEADER	MedCom Header Info	OB	1
(0029,xx20)	SIEMENS MEDCOM HEADER	MedCom History Information	OB	1
(0029,xx31)	SIEMENS MEDCOM HEADER	PMTF Information 1	LO	1
(0029,xx32)	SIEMENS MEDCOM HEADER	PMTF Information 2	UL	1
(0029,xx33)	SIEMENS MEDCOM HEADER	PMTF Information 3	UL	1
(0029,xx34)	SIEMENS MEDCOM HEADER	PMTF Information 4	CS	1
(0029,xx35)	SIEMENS MEDCOM HEADER	PMTF Information 5	UL	1
(0029,xx40)	SIEMENS MEDCOM HEADER	Application Header Sequence	SQ	1
(0029,xx41)	SIEMENS MEDCOM HEADER	Application Header Type	CS	1
(0029,xx42)	SIEMENS MEDCOM HEADER	Application Header ID	LO	1
(0029,xx43)	SIEMENS MEDCOM HEADER	Application Header Version	LO	1
(0029,xx44)	SIEMENS MEDCOM HEADER	Application Header Info	OB	1
(0029,xx50)	SIEMENS MEDCOM HEADER	Workflow Control Flags	LO	8
(0029,xx51)	SIEMENS MEDCOM HEADER	Arch. Management Flag Keep Online	CS	1
(0029,xx52)	SIEMENS MEDCOM HEADER	Arch. Mgmnt Flag Do Not Archive	CS	1
(0029,xx53)	SIEMENS MEDCOM HEADER	Image Location Status	CS	1
(0029,xx54)	SIEMENS MEDCOM HEADER	Estimated Retrieve Time	DS	1
(0029,xx55)	SIEMENS MEDCOM HEADER	Data Size of Retrieved Images	DS	1
(0029,xx08)	SIEMENS MEDCOM OOG	MedCom OOG Type	CS	1
(0029,xx09)	SIEMENS MEDCOM OOG	MedCom OOG Version	LO	1
(0029,xx10)	SIEMENS MEDCOM OOG	MedCom OOG Info	OB	1
(7FE1,xx10)	SIEMENS CSA NON-IMAGE	CSA Data	OB	1

A.4 Standard Extensions of all SOP Classes

The following tables list the data dictionary of all DICOM IOD attributes where the DICOM standard definitions are extended:

Attribute Name	Tag	Private Creator	Type	Notes
Image Type	(0008,0008)	-	1	see A.4.1 additional Defined Terms: Defined Terms for value 3: OTHER Defined Terms for value 4: CSA 3D EDITOR CSA 3D FLY PATH CSA 3D FLY VRT CSA 3D FUSION CSA AVERAGE CSA BLACK IMAGE CSA RESAMPLED CSA MIP CSA MPR CSA MPR CURVED CSA MPR THICK CSA SSD CSA SUBTRACT CT_SOM4 * ECAT ACF ECAT NORMAL ECAT 3D SINO ECAT 3D SINO FLT SHS * CSA DRR OCS_SAVEASREF
Patient Position	(0018,5100)	-	2C	see A.4.2 additional Defined Terms for the Magnetom Open: HLS HLP FLS FLP HLDL HLDR FLDL FLDR

All SOP classes may contain additional type 3 attributes which DICOM standard defines in a different DICOM IOD or DICOM SOP class (attributes from Normalized SOP classes).

This is the case for example for

- Rescale Slope (0028,1053)
- Rescale Intercept (0028,1052)

which are also used in the MR IOD.

A.4.1 Image Type

The Image Type (0008,0008) attribute identifies important image identification characteristics. These characteristics are:

Pixel Data Characteristics:

- is the image an ORIGINAL Image; an image whose pixel values are based on original or source data, or
- is the image a DERIVED Image; an image whose pixel values have been derived in some manner from the pixel value of one or more other images.

Patient Examination Characteristics:

- is the image a PRIMARY Image; an image created as a direct result of the Patient examination, or
- is the image a SECONDARY Image; an image created after the initial Patient examination.

Modality Specific Characteristics (SOP Specific Characteristics).

Implementation specific identifiers; other implementation specific identifiers shall be documented in an implementation's conformance claim.

The Image Type attribute is multi-valued and shall be provided in the following manner:

- Value 1 shall identify the Pixel Data Characteristics; Enumerated Values for the Pixel Data Characteristics are:
  - ORIGINAL = identifies an Original Image
  - DERIVED = identifies a Derived Image
- Value 2 shall identify the Patient Examination Characteristics; Enumerated Values for the Patient Examination Characteristics are:
  - PRIMARY = identifies a Primary Image
  - SECONDARY = identifies a Secondary Image
- Value 3 shall identify any Image IOD specific specialization, the following terms are defined in addition to the DICOM standard definitions:
  - OTHER = is also used for converted non-Axial and non-Localizer CT images
  - MPR = for 3D MPR images
  - PROJECTION IMAGE = for 3D MIP and SSD images
  - DRR = Digitally reconstructed Radiograph
  - PORTAL = Radiation Therapy Portal Image
  - SIMULATED = Image from a Radiation Therapy Plan Simulator
- Value 4 which are implementation specific, the following terms are defined in addition to the DICOM standard definitions:

original *syngo* generated data set types:

CSA 3D EDITOR = object created by 3D Editor
CSA 3D FLY PATH = object created by Fly Through Path
CSA 3D FLY VRT = object created by Fly Through Volume Rendering Technique
CSA 3D FUSION = object created by Fusion
CSA AVERAGE = image was created by Average
CSA BLACK IMAGE = SC Image with black pixels, only graphics information is of interest
CSA RESAMPLED = derived image created by zooming or panning original image
CSA REPORT = *syngo* reporting (documentation of diagnosis)
CSA RESULT = *syngo* reporting (postprocessing results)
CSA MIP = image created by Maximum Intensity Projection
CSA MIP THIN = image created by Maximum Intensity Projection
CSA MPR = image created by Multi Planar Reconstruction

CSA MPR CURVED = image created by Multi Planar Reconstruction
CSA MPR THICK = image created by Multi Planar Reconstruction
CSA MPR THIN = image created by Multi Planar Reconstruction
CSA SSD = SC Image as Shaded Surface Display
CSA SUBTRACT = image was created by Subtraction
ECAT ACF = CTI PET Attenuation Correction
ECAT NORMAL = CTI PET Normalization
ECAT 3D SINO = CTI PET 3D Sinogram Short
ECAT 3D SINO FLT = CTI PET 3D Sinogram Float
CSA DRR = Digitally reconstructed Radiograph
OCS_SAVEASREF = Reference Image for Patient Positioning

- Converted images

CT_SOM4 NONE = converted SOMARIS image
CT_SOM4 CONV = converted SOMARIS Convolution Kernel file
CT_SOM4 DART = converted SOMARIS Dental Artificial image
CT_SOM4 DEVA = converted SOMARIS Dental Evaluation image
CT_SOM4 DGRA = converted SOMARIS Dental Graphics image
CT_SOM4 DMEA = converted SOMARIS Dynamic Measurement image
CT_SOM4 DPAN = converted SOMARIS Dental Panorama image
CT_SOM4 DPAR = converted SOMARIS Dental Paraxial image
CT_SOM4 EBT = converted SOMARIS Evolution image
CT_SOM4 HIS = converted SOMARIS Histogram Graphics image
CT_SOM4 HISC = converted SOMARIS Histogram Graphics image
CT_SOM4 MUL = converted SOMARIS Multiscan image
CT_SOM4 OEVA = converted SOMARIS Osteo Evaluation image
CT_SOM4 OTOM = converted SOMARIS Osteo Tomogram image
CT_SOM4 OTOP = converted SOMARIS Osteo Topogram image
CT_SOM4 PLOT = converted SOMARIS Plot image
CT_SOM4 QUAL = converted SOMARIS Quality image
CT_SOM4 R2D = converted SOMARIS 2D Rebuild image
CT_SOM4 R3D = converted SOMARIS 3D Rebuild image
CT_SOM4 R3DE = converted SOMARIS 3D Rebuild image
CT_SOM4 RMAX = converted SOMARIS Maximum Intensity Projection image
CT_SOM4 RMIN = converted SOMARIS Minimum Intensity Projection image
CT_SOM4 ROT = converted SOMARIS Rotation Mode image
CT_SOM4 RRAD = converted SOMARIS Radiographic Projection image
CT_SOM4 RVIT = converted SOMARIS Vessel Image Tool image
CT_SOM4 RVRT = converted SOMARIS Volumetric Rendering image
CT_SOM4 SAVE = converted SOMARIS Evolution Screen Save image
CT_SOM4 SCAN = converted SOMARIS Standard Mode image
CT_SOM4 SEQ = converted SOMARIS Sequence Mode image
CT_SOM4 SER = converted SOMARIS Serial Mode image
CT_SOM4 SIN = converted SOMARIS Sinogram image
CT_SOM4 SINC = converted SOMARIS Sinogram image
CT_SOM4 SPI = converted SOMARIS Spiral Mode image
CT_SOM4 STA = converted SOMARIS Static Mode image
CT_SOM4 TAB = converted SOMARIS Correction Table image
CT_SOM4 TOP = converted SOMARIS Topogram image
CT_SOM4 GTOP = converted SOMARIS Topo Graphics image

CT_SOM4 PEVG = converted SOMARIS Pulmo Evaluation image
CT_SOM4 PEVI = converted SOMARIS Pulmo Evaluation image
CT_SOM4 PUL = converted SOMARIS Pulmo Respiration image
CT_SOM4 PROT = converted SOMARIS Protocol image
CT_SOM4 TEXT = converted SOMARIS Text image
CT_SOM4 ICD = converted SOMARIS Interventional Cine image
SHS DENT = converted MagicView Dental Tomogram image
SHS DPAN = converted MagicView Dental Panorama image
SHS DPAR = converted MagicView Dental Paraxial image
SHS 3D_CURVED = converted MagicView image
SHS 3D_MIP = converted MagicView Maximum Intensity Projection image
SHS 3D_MPR = converted MagicView Multi Planar Reconstruction image
SHS 3D_SSD = converted MagicView Shaded Surface Display image
SHS 3D_VRT = converted MagicView Volumetric Rendering image

A.4.2 Patient Position

The Patient Position attribute (0018,5100) defines the patient position relative to the equipment.

The Defined Terms for this value were extended for the MAGNETOM OPEN product. Here the patient is not positioned Head First/Feet First when facing the front of the imaging equipment but Head Left or Feet Left.

The new va\lues are:

- HLS (Head left - Supine)
- HLP (Head left - Prone)
- FLS (Feet left - Supine)
- FLP (Feet left - Prone)
- HLDL (Head left - Decubitus left)
- HLDR (Head left - Decubitus right)
- FLDL (Feet left - Decubitus left)
- FLDR (Feet left - Decubitus right)

A.5 OCS SOP UIDs

All UIDs for OCS products will be generated according to the following template:

1.3.12.2.1107.5.<GG>.<product>.<serial_no><variable part of UID>

The GG number of OCS is 7.

The products are defined as follows:

- 1 = Reserved
- 2 = BeamView
- 3 = Oncologist Workspace
- 4 = Physicist Workspace
- 5 = KonRad Planning System
- 6 = Cosmic MLC control software
- 7 = Therapist Workspace (V1.0.500 and higher), *syngo* RT Therapist (4.1 and higher), or PRIMEVIEW 3*i*
- 8 = Dosimetrist Workspace (starting with V2.2)
- 9 = PRIMEVIEW DICOM Gateway

A.6 DICOM Print SCU – Detailed Status Displays

The following tables document the behavior of the *syngo* RT DICOM Print AE in response to messages received for the printer SOP class and the print job SOP class.

Definitions of camera symbols:

- Idle: Camera is installed and ready; idle icon is displayed.
- Interact: The user has to react in near future, but not immediately.
  Example: A camera was low in 8x10 clear sheets: LOW 8x10 CLR was sent by n-event-report.
- Queue Stopped: The user has to react immediately. Either the camera needs immediate interaction or a job has been aborted.
  Example: A camera is out of 8x10 clear sheets, or camera is down, or a film job is aborted.

Note: Different camera symbols are displayed according to the Printer Status Info.

The Printer Status (Success, Warning, Failure) is not evaluated, since the Printer Status Info is much more detailed and allows a more appropriate reaction of the system.

A.6.1 Common Status Information

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
NORMAL	Camera is ready	Camera is ready	<None>/idle
BAD RECEIVE MGZ	There is a problem with the film receive magazine. Films from the printer cannot be transported into the magazine.	Problem with receive magazine.	<None>/interact
BAD SUPPLY MGZ	There is a problem with the film supply magazine. Films from this magazine cannot be transported into the printer.	Problem with supply magazine.	<None>/interact
CALIBRATING	Printer is performing self calibration, it is expected to be available for normal operation shortly.	Self calibration. Please wait.	<None>/idle
CALIBRATION ERR	An error in the printer calibration has been detected, quality of processed films may not be optimal.	Problem in calibration. Film quality may not be optimal.	<None>/interact
CHECK CHEMISTRY	A problem with the processor chemicals has been detected, quality of processed films may not be optimal.	Problem with chemistry. Film quality may not be optimal.	<None>/interact
CHECK SORTER	There is an error in the film sorter	Error in film sorter.	<None>/interact
CHEMICALS EMPTY	There are no processing chemicals in the processor, films will not be printed and processed until the processor is back to normal.	Camera chemistry empty. Please check.	<None>/interact
CHEMICALS LOW	The chemical level in the processor is low, if not corrected, it will probably shut down soon.	Camera chemistry low. Please check.	<None>/interact
COVER OPEN	One or more printer or processor covers, drawers, doors are open.	Camera cover, drawer or door open.	<None>/interact
ELEC CONFIG ERR	Printer configured improperly for this job.	Camera configured improperly for this job. Queue stopped.	Queue for this camera will be STOPPED/ Queue stopped
ELEC DOWN	Printer is not operating due to	Camera electrical	<None>/interact

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
	some unspecified electrical hardware problem.	hardware Problem.	
ELEC SW ERROR	Printer not operating for some unspecified software error.	Camera software problem. Queue stopped.	Queue for this camera will be STOPPED/ Queue stopped
EMPTY 8x10	The 8x10 inch film supply magazine is empty.	8x10 film supply empty.	<None>/interact
EMPTY 8x10 BLUE	The 8x10 inch blue film supply magazine is empty.	8x10 blue film supply empty.	<None>/interact
EMPTY 8x10 CLR	The 8x10 inch clear film supply magazine is empty.	8x10 clear film supply empty.	<None>/interact
EMPTY 8x10 PAPR	The 8x10 inch paper supply magazine is empty.	8x10 paper supply empty.	<None>/interact
EMPTY 10x12	The 10x12 inch film supply magazine is empty.	10x12 film supply empty.	<None>/interact
EMPTY 10x12 BLUE	The 10x12 inch blue film supply magazine is empty.	10x12 blue film supply empty.	<None>/interact
EMPTY 10x12 CLR	The 10x12 inch clear film supply magazine is empty.	10x12 clear film supply empty.	<None>/interact
EMPTY 10x12 PAPR	The 10x12 inch paper supply magazine is empty.	10x12 paper supply empty.	<None>/interact
EMPTY 10x14	The 10x14 inch film supply magazine is empty.	10x14 film supply empty.	<None>/interact
EMPTY 10x14 BLUE	The 10x14 inch blue film supply magazine is empty.	10x14 blue film supply empty.	<None>/interact
EMPTY 10x14 CLR	The 10x14 inch clear film supply magazine is empty.	10x14 clear film supply empty.	<None>/interact
EMPTY 10x14 PAPR	The 10x14 inch paper supply magazine is empty.	10x14 paper supply empty.	<None>/interact
EMPTY 11x14	The 11x14 inch film supply magazine is empty.	11x14 film supply empty.	<None>/interact
EMPTY 11x14 BLUE	The 11x14 inch blue film supply magazine is empty.	11x14 blue film supply empty.	<None>/interact
EMPTY 11x14 CLR	The 11x14 inch clear film supply magazine is empty.	11x14 clear film supply empty.	<None>/interact
EMPTY 11x14 PAPR	The 11x14 inch paper supply magazine is empty.	11x14 paper supply empty.	<None>/interact
EMPTY 14x14	The 14x14 inch film supply magazine is empty.	14x14 film supply empty.	<None>/interact
EMPTY 14x14 BLUE	The 14x14 inch blue film supply magazine is empty.	14x14 blue film supply empty.	<None>/interact
EMPTY 14x14 CLR	The 14x14 inch clear film supply magazine is empty.	14x14 clear film supply empty.	<None>/interact
EMPTY 14x14 PAPR	The 14x14 inch paper supply magazine is empty.	14x14 paper supply empty.	<None>/interact
EMPTY 14x17	The 14x17 inch film supply magazine is empty.	14x17 film supply empty.	<None>/interact
EMPTY 14x17 BLUE	The 14x17 inch blue film supply magazine is empty.	14x17 blue film supply empty.	<None>/interact
EMPTY 14x17 CLR	The 14x17 inch clear film supply magazine is empty.	14x17 clear film supply empty.	<None>/interact
EMPTY 14x17 PAPR	The 14x17 inch paper supply magazine is empty.	14x17 paper supply empty.	<None>/interact
EMPTY 24x24	The 24x24 inch film supply magazine is empty.	24x24 film supply empty.	<None>/interact
EMPTY 24x24 BLUE	The 24x24 inch blue film supply magazine is empty.	24x24 blue film supply empty.	<None>/interact
EMPTY 24x24 CLR	The 24x24 inch clear film supply magazine is empty.	24x24 clear film supply empty.	<None>/interact

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
EMPTY 24x24 PAPR	The 24x24 inch paper supply magazine is empty.	24x24 paper supply empty	<None>/interact
EMPTY 24x30	The 24x30 inch film supply magazine is empty.	24x30 film supply empty.	<None>/interact
EMPTY 24x30 BLUE	The 24x30 inch blue film supply magazine is empty.	24x30 blue film supply empty.	<None>/interact
EMPTY 24x30 CLR	The 24x30 inch clear film supply magazine is empty.	24x30 clear film supply empty.	<None>/interact
EMPTY 24x30 PAPR	The 24x30 inch paper supply magazine is empty.	24x30 paper supply empty.	<None>/interact
EMPTY A4 PAPR	The A4 paper supply magazine is empty.	A4 paper supply empty	<None>/interact
EMPTY A4 TRANS	The A4 transparency supply magazine is empty.	A4 transparency supply empty.	<None>/interact
EXPOSURE FAILURE	The exposure device has failed due to some unspecified reason.	Exposure device has failed.	<None>/interact
FILM JAM	A film transport error has occurred and a film is jammed in the printer or processor.	Film jam.	<None>/interact
FILM TRANSP ERR	There is a malfunction with the film transport, there may or may not be a film jam.	Film transport problem.	<None>/interact
FINISHER EMPTY	The finisher is empty.	Finisher is empty.	<None>/interact
FINISHER ERROR	The finisher is not operating due to some unspecified reason	Finisher problem.	<None>/interact
FINISHER LOW	The finisher is low on supplies.	Finisher low.	<None>/interact
LOW 8x10	The 8x10 inch film supply magazine is low.	8x10 film supply low.	<None>/interact
LOW 8x10 BLUE	The 8x10 inch blue film supply magazine is low.	8x10 blue film supply low.	<None>/interact
LOW 8x10 CLR	The 8x10 inch clear film supply magazine is low.	8x10 clear film supply low.	<None>/interact
LOW 8x10 PAPR	The 8x10 inch paper supply magazine is low.	8x10 paper supply low.	<None>/interact
LOW 10x12	The 10x12 inch film supply magazine is low.	10x12 film supply low.	<None>/interact
LOW 10x12 BLUE	The 10x12 inch blue film supply magazine is low.	10x12 blue film supply low.	<None>/interact
LOW 10x12 CLR	The 10x12 inch clear film supply magazine is low.	10x12 clear film supply low.	<None>/interact
LOW 10x12 PAPR	The 10x12 inch paper supply magazine is low.	10x12 paper supply low.	<None>/interact
LOW 10x14	The 10x14 inch film supply magazine is low.	10x14 film supply low.	<None>/interact
LOW 10x14 BLUE	The 10x14 inch blue film supply magazine is low.	10x14 blue film supply low.	<None>/interact
LOW 10x14 CLR	The 10x14 inch clear film supply magazine is low.	10x14 clear film supply low.	<None>/interact
LOW 10x14 PAPR	The 10x14 inch paper supply magazine is low.	10x14 paper supply low.	<None>/interact
LOW 11x14	The 11x14 inch film supply magazine is low.	11x14 film supply low.	<None>/interact
LOW 11x14 BLUE	The 11x14 inch blue film supply magazine is low.	11x14 blue film supply low.	<None>/interact
LOW 11x14 CLR	The 11x14 inch clear film supply magazine is low.	11x14 clear film supply low.	<None>/interact
LOW 11x14 PAPR	The 11x14 inch paper supply	11x14 paper supply low.	<None>/interact

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
	magazine is low.		
LOW 14x14	The 14x14 inch film supply magazine is low.	14x14 film supply low.	<None>/interact
LOW 14x14 BLUE	The 14x14 inch blue film supply magazine is low.	14x14 blue film supply low.	<None>/interact
LOW 14x14 CLR	The 14x14 inch clear film supply magazine is low.	14x14 clear film supply low.	<None>/interact
LOW 14x14 PAPR	The 14x14 inch paper supply magazine is low.	14x14 paper supply low.	<None>/interact
LOW 14x17	The 14x17 inch film supply magazine is low.	14x17 film supply low.	<None>/interact
LOW 14x17 BLUE	The 14x17 inch blue film supply magazine is low.	14x17 blue film supply low.	<None>/interact
LOW 14x17 CLR	The 14x17 inch clear film supply magazine is low.	14x17 clear film supply low.	<None>/interact
LOW 14x17 PAPR	The 14x17 inch paper supply magazine is low.	14x17 paper supply low.	<None>/interact
LOW 24x24	The 24x24 inch film supply magazine is low.	24x24 film supply low.	<None>/interact
LOW 24x24 BLUE	The 24x24 inch blue film supply magazine is low.	24x24 blue film supply low.	<None>/interact
LOW 24x24 CLR	The 24x24 inch clear film supply magazine is low.	24x24 clear film supply low.	<None>/interact
LOW 24x24 PAPR	The 24x24 inch paper supply magazine is low.	24x24 paper supply low.	<None>/interact
LOW 24x30	The 24x30 inch film supply magazine is low.	24x30 film supply low.	<None>/interact
LOW 24x30 BLUE	The 24x30 inch blue film supply magazine is low.	24x30 blue film supply low.	<None>/interact
LOW 24x30 CLR	The 24x30 inch clear film supply magazine is low.	24x30 clear film supply low.	<None>/interact
LOW 24x30 PAPR	The 24x30 inch paper supply magazine is low.	24x30 paper supply low.	<None>/interact
LOW A4 PAPR	The A4 paper supply magazine is low.	A4 paper supply low.	<None>/interact
LOW A4 TRANS	The A4 transparency supply magazine is low..	A4 transparency supply low.	<None>/interact
NO RECEIVE MGZ	The film receive magazine is not available.	Film receiver not available.	<None>/interact
NO RIBBON	The ribbon cartridge needs to be replaced.	Replace ribbon cartridge.	<None>/interact
NO SUPPLY MGZ	The film supply magazine is not available.	Film supply not available.	<None>/interact
CHECK PRINTER	The printer is not ready at this time, operator intervention is required to make the printer available.	Check camera.	<None>/interact
CHECK PROC	The processor is not ready at this time, operator intervention is required to make the printer available.	Check processor.	<None>/interact
PRINTER DOWN	The printer is not operating due to some unspecified reason.	Camera down.	<None>/interact
PRINTER INIT	The printer is not ready at this time, it is expected to become available without intervention. For example, it may be in a normal warm-up state.	Camera initializing.	<None>/Idle
PRINTER OFFLINE	The printer has been disabled	Camera off-line.	<None>/interact

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
	by an operator or service person.		
PROC DOWN	The processor is not operating due to some unspecified reason.	Processor down.	<None>/interact
PROC INIT	The processor is not ready at this time, it is expected to become available without intervention. For example, it may be in a normal warm-up state.	Processor initializing.	<None>/Idle
PROC OVERFLOW FL	Processor chemicals are approaching the overflow full mark.	Processor chemicals near overflow.	<None>/interact
PROC OVERFLOW HI	Processor chemicals have reached the overflow full mark.	Processor chemicals overflow.	<None>/interact
QUEUED	Print job in Queue	--	<None>/Idle
RECEIVER FULL	The film receive magazine is full.	Receiver full.	<None>/interact
REQ MED NOT INST	The requested film, paper, or other media supply magazine is installed in the printer, but may be available with operator intervention.	Install media supply.	<None>/interact
REQ MED NOT AVAI	The requested film, paper, or other media requested is not available on this printer.	Media supply not available on this camera. Queue stopped. Change camera.	Queue for this camera will be STOPPED/ Queue stopped
RIBBON ERROR	There is an unspecified problem with the print ribbon.	Error with print ribbon.	<None>/interact
SUPPLY EMPTY	The printer is out of film.	Camera out of film.	<None>/interact
SUPPLY LOW	The film supply is low.	Film supply low.	<None>/interact
UNKNOWN	There is an unspecified problem.	Unspecified problem with camera.	<None>/interact

A.6.2 Additional Status Information – AGFA printers

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
WARMING UP	Printer is in the warm-up stage. Spooling of print jobs to disk is still possible.	Camera is warming up.	<None>/idle
OFFLINE	OFFLINE Printer is switched off-line. Spooling of print jobs to disk is still possible.	Camera is switched off-line.	<None>/interact
NONE	General printer warning, no specific information is available. Spooling of print jobs to disk is still possible.	--	<None>/idle

A.6.3 Additional Status Information – Kodak PACS Link (formerly Imation)

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
SUPPLY MGZ ERR	The supply magazine has an error.	Film supply has an error.	<None>/interact

A.6.4 Additional Status Information – Kodak 1901

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
PRINTER STOPPED	The printer has stopped.	Camera has stopped.	<None>/interact
FATAL ERROR	Fatal Error.	Fatal Error. Queue stopped.	Queue for this camera will be STOPPED/ Queue stopped

A.6.5 Additional Status Information – Kodak 2180/1120

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
PRINTER NOT RDY	Printer not ready.	Camera not ready..	<None>/interact
CHECK PROCESSOR	Check processor.	Check processor.	<None>/interact
NO TONER	No toner.	No toner.	<None>/interact
FATAL	Fatal Error.	Fatal Error. Queue stopped.	Queue for this camera will be STOPPED/ Queue stopped

A.6.6 Additional Status Information – Codonics

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
STANDARD	Printer is ready.	Camera is ready.	<None>/Normal
LOAD A-SIZE	Load A-Size media.	Load A-Size media.	<None>/interact
LOAD A-DVPAPER	Load A-Size black and white paper.	Load A-Size black and white paper.	<None>/interact
LOAD A-CVPAPER	Load A-Size color paper.	Load A-Size color paper.	<None>/interact
LOAD A-CVTRANS	Load A-Size transparencies.	Load A-Size transparencies.	<None>/interact
LOAD A4-SIZE	Load A4-Size media.	Load A4-Size media.	<None>/interact
LOAD A4-DVPAPER	Load A4-Size black and white paper.	Load A4-Size black and white paper.	<None>/interact
LOAD A4-CVPAPER	Load A4-Size color paper.	Load A4-Size color paper.	<None>/interact
LOAD A4-CVTRANS	Load A4-Size transparencies.	Load A4-Size transparencies.	<None>/interact
LOAD LA-SIZE	Load LA-Size media.	Load LA-Size media.	<None>/interact
LOAD LA-DVPAPER	Load LA-Size black and white paper.	Load LA-Size black and white paper.	<None>/interact
LOAD LA-CVPAPER	Load LA-Size color paper.	Load LA-Size color paper.	<None>/interact
LOAD LA-CVTRANS	Load LA-Size transparencies.	Load LA-Size transparencies.	<None>/interact
LOAD LA4-SIZE	Load LA4-Size media.	Load LA4-Size media.	<None>/interact
LOAD LA4-DVPAPER	Load LA4-Size black and white paper.	Load LA4-Size black and white paper.	<None>/interact

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
LOAD LA4-CVPAPER	Load LA4-Size color paper.	Load LA4-Size color paper.	<None>/interact
LOAD LA4-CVTRANS	Load LA4-Size transparencies.	Load LA4-Size transparencies.	<None>/interact
LOAD XLA-SIZE	Load XLA-Size media.	Load XLA-Size media.	<None>/interact
LOAD XLA-DVPAPER	Load XLA-Size black and white paper.	Load XLA-Size black and white paper.	<None>/interact
LOAD XLA-CVPAPER	Load XLA-Size color paper.	Load XLA-Size color paper.	<None>/interact
LOAD XLA-CVTRANS	Load XLA-Size transparencies.	Load XLA-Size transparencies.	<None>/interact
LOAD XLA4-SIZE	Load XLA4-Size media.	Load XLA4-Size media.	<None>/interact
LOAD XLA4-DVPAPER	Load XLA4-Size black and white paper.	Load XLA4-Size black and white paper.	<None>/interact
LOAD XLA4-CVPAPER	Load XLA4-Size color paper.	Load XLA4-Size color paper.	<None>/interact
LOAD XLA4-CVTRANS	Load XLA4-Size transparencies.	Load XLA4-Size transparencies.	<None>/interact
LOAD XLW-SIZE	Load XLW-Size media.	Load XLW-Size media.	<None>/interact
LOAD XLW-DVPAPER	Load XLW-Size black and white paper.	Load XLW-Size black and white paper.	<None>/interact
LOAD XLW-CVPAPER	Load XLW-Size color paper.	Load XLW-Size color paper.	<None>/interact
LOAD 8X10-SIZE	Load 8x10 media.	Load 8x10 media.	<None>/interact
LOAD 8X10-DVFILM	Load XLW-Size black and white film.	Load XLW-Size black and white film.	<None>/interact
SUPPLY MISSING	The film supply magazine specified for this job is not available.	Film supply not available.	<None>/interact
RIBBON MISSING	Ribbon is missing.	Ribbon is missing.	<None>/interact
RIBBON EMPTY	Ribbon is empty.	Ribbon is empty.	<None>/interact
TOP COVER OPEN	Top cover of printer is open.	Top cover of camera is open.	<None>/interact

A.6.7 Additional DICOM Execution Status Information

Printer Status Info/ Execution Status Info	Description	Message string visible in 'Status Bar'	Other action for UI/ 'camera symbol'
INVALID PAGE DES	The specified page layout cannot be printed or other page description errors have been detected.	Film Job cannot be printed on this camera. Queue stopped. Please redirect film job.	Queue for this camera will be STOPPED/ Queue stopped
INSUFFICIENT MEMORY	There is not enough memory available to complete this job.	Not enough memory available in camera. Queue stopped. Please continue queue or change camera.	Queue for this camera will be STOPPED/ Queue stopped
NONE	General printer warning, no specific information is available. Spooling of print jobs to disk is still possible.	--	<None>/Idle

A.7 *syngo* RT Therapist 4.1

This appendix describes the *syngo* RT Therapist 4.1 Workspace (this includes *syngo* RT Therapist Assist, *syngo* RT Therapist Express, and *syngo* RT Therapist Express Assist). The *syngo* RT Therapist Workspace can deliver treatment plans out of the local *syngo* database and stored on LANTIS machines, and record the treatment results to the local *syngo* database and to LANTIS. DICOM data transfer between *syngo* RT Therapist 4.1 and LANTIS is managed by the system. Interactions with other systems such as 3rd party planning systems and archives are performed manually by the user via DICOM data import and export.

This section describes the usage of each attribute belonging to DICOM modules used within the scope of the *syngo* RT Therapist application. It lists all private attributes used in addition to the DICOM attributes. It also describes the various consistency requirements for the DICOM RT Plan.

The document is organized in the form of DICOM module tables with the usage of each attribute described in-place.

Terms used to describe the usage of DICOM attributes:

Term	Interpretation
Used (Read)	The attribute is read by syngo RT Therapist internally.
Displayed	The attribute is used and visualized but not modified in syngo RT Therapist.
Not used	The attribute's value is ignored and not written by syngo RT Therapist when writing the object.
Modified	This attribute's value is used by syngo RT Therapist and can also be modified by syngo RT Therapist.
Written	This attribute's value is filled with an appropriate value when this attribute is written
Not written	This attribute's value is not written when syngo RT Therapist creates the containing object.

The valid values for an attribute and its mode of use are described within the attribute's description or in a referenced sub-section of the document.

Note: Private attributes are always read and written by *syngo* RT Therapist. Private attributes are shown shaded in gray in the DICOM module tables.

A.7.1 DICOM Objects Within *syngo* RT Therapist

Input Data:

syngo RT Therapist loads the following DICOM IODs in different workflows:

- RT Plan
- RT Beams Treatment Record
- RT Treatment Summary Record
- DICOM Images (of modalities RT, SC and CT.)
- RT Structure Sets

Output Data:

syngo RT Therapist modifies or generates objects of the following DICOM IODs:

- RT Plan
- RT Beams Treatment Record
- RT Treatment Summary Record
- SC Image
- RT Image
- RT Structure Sets

A.7.2 Representation and Interpretation of DICOM Modules

The *syngo* RT Therapist application RT IOD specific implementation details are provided with respect to its role as SCP/ SCU in the “Usage” section.

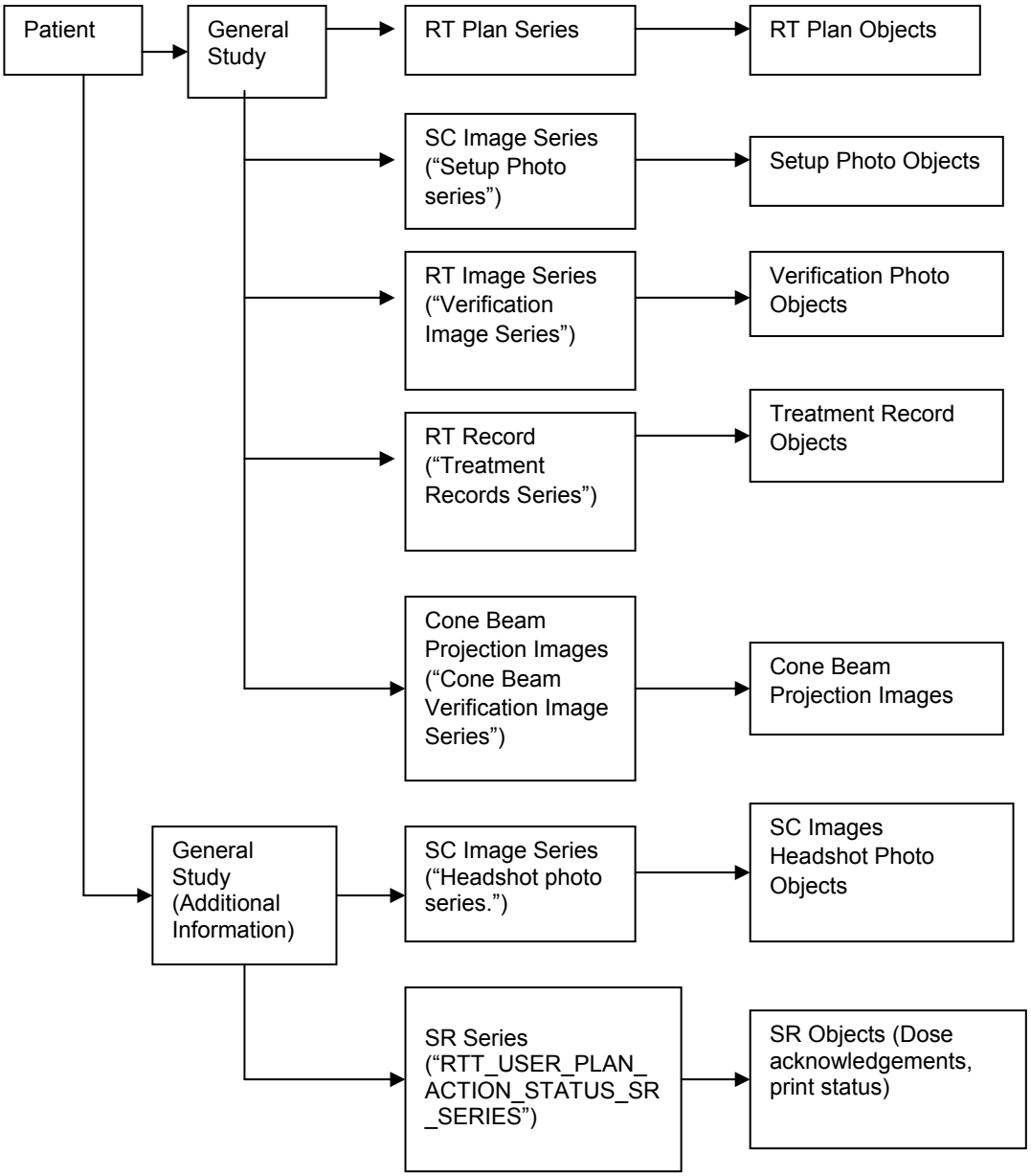

Patient
General Study
RT Plan Series
RT Plan Objects
SC Image Series (“Setup Photo series”)
Setup Photo Objects
RT Image Series (“Verification Image Series”)
Verification Photo Objects
RT Record (“Treatment Records Series”)
Treatment Record Objects
Cone Beam Projection Images (“Cone Beam Verification Image Series”)
Cone Beam Projection Images
General Study (Additional Information)
SC Image Series (“Headshot photo series.”)
SC Images Headshot Photo Objects
SR Series (“RTT_USER_PLAN_ ACTION_STATUS_SR _SERIES”)
SR Objects (Dose acknowledgements, print status)

Figure 11: Structure of the DICOM tree generated by syngo RT Therapist

Figure 11 represents the structure of the DICOM data tree generated in *syngo* RT Therapist. Each patient will have one or more DICOM general studies that contain RT Plans. Besides these studies, *syngo* RT Therapist also uses a study with the study description set to “Patient Additional information” to store patient specific information. Within this study, *syngo* RT Therapist creates one SC Image Series and one structured report object series that contain the Headshot photos and the dose acknowledgement structured reports for the patient respectively.

The studies that contain RT plans will have a series for the Setup photos, the captured verification images and the treatment records. These are created on demand by *syngo* RT Therapist when the first setup photo is added, when a verification image is captured and on the first treatment of the plan respectively.

A.7.3 DICOM IOD Modules

A.7.3.1 RT Structure Set IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	RT Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Equipment	General Equipment	M Usage: Used
Structure Set	Structure Set	M Usage: Used
	ROI Contour	M Usage: Used
	RT ROI Observations	M Usage: Used
	Approval	U Usage: Not used
	Audio	U Usage: Not used
	SOP Common	M Usage: Used

A.7.3.2 RT Plan IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	RT Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Frame of Reference	Frame of Reference	U Usage: Not used
Equipment	General Equipment	M Usage: Used
Plan	RT General Plan	M Usage: Used
	RT Prescription	U Usage: Used

IE	Module	Usage
	RT Tolerance Tables	U Usage: Used
	RT Patient Setup	U Usage: Used
	RT Fraction Scheme	U Usage: Used
	RT Beams	C - Required if RT Fraction Scheme Module exists and Number of Beams (300A,0080) is greater than zero for one or more fraction groups Usage: Used
	RT Brachy Application Setups	C - Required if RT Fraction Scheme Module exists and Number of Brachy Application Setups (300A,00A0) is greater than zero for one or more fraction groups Usage: Not used
	Approval	U Usage: used
	Audio	U Usage: Not used
	SOP Common	M Usage: Used

A.7.3.3 RT Image IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	RT Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Frame of Reference	Frame of Reference	U Usage: Not used
Equipment	General Equipment	M Usage: Used
Image	General Image	M Usage: Used
	Image Pixel	M Usage: Used
	Contrast/Bolus	C-Required if contrast media was used in this image. Usage: Not used
	Cine	M Usage: Used (for multi-frame images only.)
	Multi-Frame	C - Required if pixel data multiframe data. Usage: Used

IE	Module	Usage
	RT Image	M Usage: Used
	Modality LUT	U Usage: Not used
	VOI LUT	U Usage: Not used
	Approval	U Usage: Used
	Curve	U Usage: Not used
	Audio	U Usage: Not used
	SOP Common	M Usage: Used

A.7.3.4 SC Image IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	General Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Equipment	General Equipment	M Usage: Used
	SC Equipment	M Usage: Not Used
Image	General Image	M Usage: Used
	Image Pixel	M Usage: Used
	Device	U Usage: Not used
	SC Image	M Usage: Used
	Overlay Plane	U Usage: Not Used
	Modality LUT	U Usage: Not used
	VOI LUT	U Usage: Not used
	SOP Common	M Usage: Used

A.7.3.5 RT Beams Treatment Record IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used

IE	Module	Usage
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	RT Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Equipment	General Equipment	M Usage: Used
Treatment record	RT General Treatment Record	M Usage: Used
	RT Patient Setup	U Usage: Used
	RT Treatment Machine Record	U Usage: Used
	Measured Dose Reference Record	U Usage: Not used
	Calculated Dose Reference Record	U Usage: Used
	RT Beams Session Record	M Usage: Used
	RT Treatment Summary Record	U Usage: Not used
	Curve	U Usage: Not used
	SOP Common	M Usage: Used

A.7.3.6 RT Treatment Summary Record IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	RT Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Equipment	General Equipment	M Usage: Used
Treatment Record	RT General Treatment Record	M Usage: Used
	RT Treatment Summary Record	M Usage: Used
	Curve	U Usage: Not used
	SOP Common	M Usage: Used

A.7.3.7 Basic Text SR IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
	Clinical Trial Subject	U Usage: Not used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
	Clinical Trial Study	U Usage: Not used
Series	RT Series	M Usage: Used
	Clinical Trial Series	U Usage: Not used
Equipment	General Equipment	M Usage: Used
	SR Document General	M Usage: Used
	SR Document Content	M Usage: Used
	SOP Common	M Usage: Used

A.7.4 Patient Module

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient's full name. Usage: Displayed by *syngo* RT Therapist
Patient ID	(0010,0020)	2	Primary hospital identification number or code for the patient. Usage: Displayed by *syngo* RT Therapist
Patient's Birth Date	(0010,0030)	2	Birth date of the patient. Usage: Displayed by *syngo* RT Therapist
Patient's Sex	(0010,0040)	2	Sex of the named patient. Enumerated Values: M = male F = female O = other Usage: Displayed by *syngo* RT Therapist
Patient Comments	(0010,4000)	3	User-defined additional information about the patient. Usage: Displayed in *syngo* RT Therapist
Referenced Patient Sequence	(0008,1120)	3	A sequence which provides reference to a Patient SOP Class/Instance pair. Only a single item shall be permitted in this Sequence. Usage: Not used
Patient's Birth Time	(0010,0032)	3	Birth time of the Patient. Usage: Not used
Other Patient IDs	(0010,1000)	3	Other identification numbers or codes used to identify the patient. Usage: Not used
Other Patient Names	(0010,1001)	3	Other names used to identify the patient. Usage: Not used
Ethnic Group	(0010,2160)	3	Ethnic group or race of the patient. Usage: Not used
Patient Address	(0010,1040)	3	Legal address of the named patient. Usage: Displayed and modified in *syngo* RT Therapist.

Attribute Name	Tag	Type	Attribute Description
Patient's Telephone Number	(0010,2154)	3	Telephone numbers at which the patient can be reached. Usage: Displayed and modified in *syngo* RT Therapist The interpretation of the phone numbers are specified by index as follows: 0 Emergency Home Number 1 Emergency Cell Number 2 Emergency Work Number 3 Patient Home Number 4 Patient Cell Number 5 Patient Work Number

A.7.5 General Study Module

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the Study. Usage: Read by *syngo* RT Therapist
Study Date	(0008,0020)	2	Date the Study started. Usage: Written when a new Study is created.
Study Time	(0008,0030)	2	Time the Study started. Usage: Written when a new Study is created.
Referring Physician's Name	(0008,0090)	2	Patient's referring physician Usage: Displayed and modified.
Study ID	(0020,0010)	2	User or equipment generated Study identifier. Usage: Not used
Accession Number	(0008,0050)	2	A RIS generated number which identifies the order for the Study. Usage: Not used
Study Description	(0008,1030)	3	Institution-generated description or classification of the Study (component) performed. Usage: Used by *syngo* RT Therapist. Description used to identify the Study. See Note.
Physician(s) of Record	(0008,1048)	3	Physician(s) who are responsible for overall patient care at time of Study (see Section C.7.3.1 for Performing Physician) Usage: Displayed and modified in *syngo* RT Therapist.
Name of Physician(s) Reading Study	(0008,1060)	3	Physician(s) reading the Study. Usage: Not used
Referenced Study Sequence	(0008,1110)	3	A sequence which provides reference to a Study SOP Class/Instance pair. The sequence may have zero or more Items. Usage: Not used
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Study Sequence (0008,1110) is sent.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Study Sequence (0008,1110) is sent.
Procedure Code Sequence	(0008,1032)	3	A sequence that conveys the type of procedure performed. One or more Items may be included in this sequence. Usage: Not used

Note: *syngo* RT Therapist has a default study associated with each patient to store non-DICOM identification information like the patient's identification photo. This study will have its study description attribute set to "Patient Additional Information". This study will be unique for each patient. (Also see the list of series names used in A.7.6.1.1.)

A.7.6 RT Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. See C.7.3.1.1.1 of DICOM Part 3 for Defined Terms. Usage: Used and written by *syngo* RT Therapist.
Series Instance UID	(0020,000E)	1	Unique identifier of the Series. Usage: Written when a new series is created but not used
Series Number	(0020,0011)	2	A number that identifies this Series. Usage: Written when a new series is created but not used.
Series Description	(0008,103E)	3	User provided description of the Series. Usage: This Description is used to store a unique name for the series within a study module. (Only for series' created by *syngo* RT Therapist.) See Note 1.
Performing Physicians' Name	(0008,1050)	3	Name of the physician(s) administering the Series. Usage: Displayed and modified in *syngo* RT Therapist.
Referenced Study Component Sequence	(0008,1111)	3	Uniquely identifies the Study Component SOP Instances to which the series is related. One or more items may be included in this sequence. Usage: Not used.
Request Attributes Sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items. Usage: Not used.
Performed Procedure Step ID	(0040,0253)	3	Identification of that part of a Procedure that has been carried out within this step. Usage: Not used.
Performed Procedure Step Start Date	(0040,0244)	3	Date on which the Performed Procedure Step started. Usage: Not used.
Performed Procedure Step Start Time	(0040,0245)	3	Time on which the Performed Procedure Step started. Usage: Not used.
Performed Procedure Step Description	(0040,0254)	3	Institution-generated description or classification of the Procedure Step that was performed. Usage: Not used.
Performed Protocol Sequence	(0040,0260)	3	Sequence describing the Protocol performed for this Procedure Step. One or more Items may be included in this sequence. Usage: Not used.

Note 1: *syngo* RT Therapist Named series

A study contains multiple series'. In order to identify those series' generated by *syngo* RT Therapist, each such series will be named using the 'Series Description' attribute. If any of these series are not present at load time, then they are created on demand and the appropriate information written into them.

For example, *syngo* RT Therapist generates verification images that will be stored in an RT Image series. In order to distinguish this series from any other RT Image series under the same study, the series will be given a unique name in the Series Description attribute of the RT Series module. Each plan will have all it's verification images stored in a series 'Verification Image Series' under the same study as the plan.

Note 2: *syngo* RT Therapist reads the Attending Physician name from the following attributes, in that order

Physician of Record (0008,1048)

Performing Physician (0008,1050)

Referring Physician (0008,0090)

syngo RT Therapist sets all the same value to all of the above attributes before transferring the objects to OIS or CR.

A.7.6.1.1 *syngo* RT Therapist Series Names

Series Name	Series Modality	Series Description
Patient Headshot Photo Series	OT	This series will contain the patient headshot photo. It will only be present within the study with description "Patient Additional Information". (See General Study Module - Note.)
Verification Image Series	RTIMAGE	All the verification images of the plan under the study will be stored in this series.
Setup Photo Series	OT	Setup photos required by setups within the plan under the study will be stored in this series.
Treatment Records Series	RTRECORD	Treatment records generated for the plan under the study will be stored in this series.
syngo RT Therapist_USER_PLAN_ACTION_STATUS_SR_SERIES	SR	Dose acknowledgements and patient treatment chart print status information for all plans of the patient.
Cone Beam Verification Image Series	RT	Projection images for Cone beam delivery.

A.7.7 General Equipment Module

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	Manufacturer of the equipment that produced the composite instances. Usage: Written by *syngo* RT Therapist
Institution Name	(0008,0080)	3	Institution where the equipment that produced the composite instances is located. Usage: Written by *syngo* RT Therapist
Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment that produced the composite instances is located. Usage: Written by *syngo* RT Therapist
Station Name	(0008,1010)	3	User defined name identifying the machine that produced the composite instances. Usage: Written by *syngo* RT Therapist
Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment that produced the composite instances is located. Usage: Written by *syngo* RT Therapist

Attribute Name	Tag	Type	Attribute Description
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that produced the composite instances. Usage: Written by *syngo* RT Therapist
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that produced the composite instances. **Note:** This identifier corresponds to the device that actually created the images, such as a CR plate reader or a CT console, and may not be sufficient to identify all of the equipment in the imaging chain, such as the generator or gantry or plate. Usage: Written by *syngo* RT Therapist
Software Versions	(0018,1020)	3	Manufacturer's designation of software version of the equipment that produced the composite instances. Usage: Written by *syngo* RT Therapist
Spatial Resolution	(0018,1050)	3	The inherent limiting resolution in mm of the acquisition equipment for high contrast objects for the data gathering and reconstruction technique chosen. If variable across the images of the series, the value at the image center. Usage: Not used
Date of Last Calibration	(0018,1200)	3	Date when the image acquisition device calibration was last changed in any way. Multiple entries may be used for additional calibrations at other times. See C.7.5.1.1.1 for further explanation. Usage: Written by *syngo* RT Therapist
Time of Last Calibration	(0018,1201)	3	Time when the image acquisition device calibration was last changed in any way. Multiple entries may be used. See C.7.5.1.1.1 for further explanation. Usage: Written by *syngo* RT Therapist
Pixel Padding Value	(0028,0120)	3	Value of pixels not present in the native image added to an image to pad to rectangular format. See C.7.5.1.1.2 for further explanation. **Note:** The Value Representation of this Attribute is determined by the value of Pixel Representation (0028,0103) Usage: Not used

A.7.8 RT Dose Module

NOT USED

A.7.9 RT DVH Module

NOT USED

A.7.10 Structure Set Module

The RT Structure Set module and its sub-modules are read and modified by the Adaptive targeting application within *syngo* RT Therapist.

Attribute Name	Tag	Type	Attribute Description
Structure Set Name	(3006,0004)	3	User-defined name for Structure Set. Usage: Used and written by *syngo* RT Therapist. On save, Always "VT_1.0"
Structure Description	(3006,0006)	3	User-defined description for Structure Set. Usage: Used and written by *syngo* RT Therapist. On save, "VT_Planning" if structure set is created by

Attribute Name	Tag	Type	Attribute Description
			VT for planning data or imported by VT. Else as set in original.
Instance Number	(0020,0013)	3	A number that identifies this object Instance. Usage: Used and written by *syngo* RT Therapist. On save, set to integer value generated internally.
Structure Set Date	(3006,0008)	2	Date at which Structure Set was last modified. Usage: Used and written by *syngo* RT Therapist
Structure Set Time	(3006,0009)	2	Time at which Structure Set was last modified. Usage: Used and written by *syngo* RT Therapist
Tx_RTPLAN_INFO	(0039,xx08)	2	Treatment Plan UID is a private attribute Usage: Used and written by *syngo* RT Therapist.
SIEMENS MED OCS SS VERSION INFO	(0039,xx76)	2	Predecessor Structure Set UID is a private attribute Usage: Written by *syngo* RT Therapist.
SIEMENS_MED_OCS_SS _DISPLAY_INFO	(0039,xx78)	2	ROI Visibility is a private attribute Usage: Written by *syngo* RT Therapist. Saved in triplets of ROI name, ROI number and visibility (as a bool).
Referenced Frame of Reference Sequence	(3006,0010)	3	Introduces sequence of items describing Frames of Reference in which the ROIs redefined. One or more items may be included in this sequence. Usage: Used and written by *syngo* RT Therapist. On save, only one sequence object is created.
>Frame of Reference Relationship Sequence	(3006,00C0)	3	Introduces sequence of transforms that relate other Frames of Reference to this Frame of Reference. Usage: Used and written by *syngo* RT Therapist. Only one Reference relation ship SQ is created. This sequence is sent for treatment structure set.
>>Related Frame of Reference UID	(3006,00C2)	1C	Frame of Reference Coordinate System to be transformed to the current Frame of Reference. Required if Frame of Reference Relationship Sequence (3006,00C0) is sent. Usage: Planning data set frame of reference UID is set here.
>>Frame of Reference Transformation Type	(3006,00C4)	1C	Type of Transformation. Required if Frame of Reference Relationship Sequence (3006,00C0) is sent. Defined Terms: HOMOGENEOUS Usage: Not used
>>Frame of Reference Transformation Matrix	(3006,00C6)	1C	Four-by-four transformation Matrix from rRelated Frame of Reference to current Frame of Reference. Matrix elements shall be listed in row-major order. Required if Frame of Reference Relationship Sequence (3006,00C0) is sent. Usage: On save, store a 4x4 matrix showing shift from treatment to planning is stored.
>Frame of Reference UID	(0020,0052)	1C	Uniquely identifies Frame of Reference within Structure Set. Required if Referenced Frame of Reference Sequence (3006,0010) is sent. Usage: Set from CT image series on which this structure set is created.
>RT Referenced Study Sequence	(3006,0012)	3	Introduces sequence of Studies containing series to be referenced. One or more items may be included in this sequence. Usage: On save, store the reference to study to which CT series belongs
>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if RT Referenced Study Sequence (3006,0012) is sent. Usage: Used and written

Attribute Name	Tag	Type	Attribute Description
>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if RT Referenced Study Sequence (3006,0012) is sent. Usage: Used and written
>>RT Referenced Series Sequence	(3006,0014)	1C	Introduces sequence of items describing series of images within the referenced study, which are used in defining the Structure Set. Required if RT Referenced Study Sequence (3006,0012) is sent. One or more items may be included in this sequence. Usage: On save, store Reference to CT series.
>>>Series Instance UID	(0020,000E)	1C	Unique identifier for the series containing the images. Required if RT Referenced Series Sequence (3006,0014) is sent. Usage: Used and written
>>>Contour Image Sequence	(3006,0016)	1C	Introduces sequence of items describing images in a given series used in defining the Structure Set (typically CT or MR images). Required if RT Referenced Series Sequence (3006,0014) is sent. One or more items may be included in this sequence. Usage: This is reference to the CT input images. Structure set is defined/created based on these images.
>>>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced image SOP Class. Required if Contour Image Sequence (3006,0016) is sent. Usage: CT Image SOP Class UID
>>>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced image SOP Instance. Required if Contour Image Sequence (3006,0016) is sent. Usage: Used and written
>>>> Referenced Frame Number	(0008,1160)	3	Identifies image frame if a multi-frame image is referenced. Usage: Displayed by *syngo* RT Therapist
Structure Set ROI Sequence	(3006,0020)	3	Introduces sequence of ROIs for current Structure Set. One or more items may be included in this sequence. Usage: The SQ contains Structure Set ROI Sequence Reference Points.
>ROI Number	(3006,0022)	1C	Identification number of the ROI. The value of ROI Number (3006,0022) shall be unique within the Structure Set in which it is created. Required if Structure Set ROI Sequence (3006,0020) is sent. Usage: Used and written. On save, store the integer number assigned during creation of ROI.
>Referenced Frame of Reference UID	(3006,0024)	1C	Uniquely identifies Frame of Reference in which ROI is defined, specified by Frame of Reference UID (0020,0052) in Referenced Frame of Reference Sequence (3006,0010). Required if Structure Set ROI Sequence (3006,0020) is sent. Usage: Used and written
>ROI Name	(3006,0026)	2C	User-defined name for ROI. Required if Structure Set ROI Sequence (3006,0020) is sent. Usage: Used and written. On save, store name as user entered in the VT UI during creation of Ref. Point

Attribute Name	Tag	Type	Attribute Description
>ROI Generation Algorithm	(3006,0036)	2C	Type of algorithm used to generate ROI. Required if Structure Set ROI Sequence (3006,0020) is sent. Defined Terms: AUTOMATIC = calculated ROI SEMIAUTOMATIC = ROI calculated with user assistance MANUAL = user-entered ROI

A.7.11 ROI Contour Module

Attribute Name	Tag	Type	Attribute Description
ROI Contour Sequence	(3006,0039)	1	Introduces sequence of Contour Sequences Defining ROIs. One or more items may be Included in this sequence. Usage: If structure set is present, at least one ROI Contour SQ is present in structure set.
>Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020). Usage: Used and written by *syngo* RT Therapist.
>ROI Display Color	(3006,002A)	3	RGB triplet color representation for ROI specified using the range 0-255. Usage: Used and written. On save, store Either ROI color or Reference Point color is filled
>Contour Sequence	(3006,0040)	3	Introduces sequence of contours defining ROI. One or more items may be included in this sequence. Usage: If the ROI is not empty ROI, contour SQ is filled.
>>Contour Number	(3006,0048)	3	Identification number of the contour. The value of Contour Number (3006,0048) shall be unique within the Contour Sequence (3006,0040) in which it is defined. No semantics or ordering shall be inferred from this attribute. Usage: Used and written.
>> Attached Contours	(3006,0049)	3	List of Contour Number (3006,0048) defining lower-numbered contour(s) to which the current contour is connected. Usage: Not used
>>Contour Image Sequence	(3006,0016)	3	Introduces sequence of images containing the contour. One or more items may be included in this sequence. Usage: Used and written. On save, this attribute is not set for reference points / isocenters
>>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced image SOP Class of the image containing the Contour, if it exists. Required if Contour Image Sequence (3006,0016) is sent. Usage: Used and written.
>>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced image SOP Instance of the image containing the Contour, if it exists. Required if Contour Image Sequence (3006,0016) is sent. Usage: Used and written.
>>>Referenced Frame Number	(0008,1160)	1C	Identifies image frame if a multi-frame image is referenced. Required if referenced image is a multi-frame image.
>>Contour Geometric Type	(3006,0042)	1C	Geometric type of contour. Required if Contour Sequence (3006,0040) is sent. Enumerated Values: POINT = single point OPEN_PLANAR = open contour containing Coplanar points OPEN_NONPLANAR = open contour containing non-coplanar points

Attribute Name	Tag	Type	Attribute Description
			CLOSED_PLANAR = closed contour (polygon) containing coplanar points Usage: Used and written. On save, store: POINT in case of Reference Point and isocenters CLOSED_PLANAR in case of ROI
>>Contour Slab Thickness	(3006,0044)	3	Thickness of slab (in mm) represented by contour, where the Contour Data (3006,0050) defines a plane in the center of the slab, offset by the Contour Offset Vector (3006,0045) if it is present. See C.8.8.6.2. Usage: Not used
>>Contour Offset Vector	(3006,0045)	3	Vector (x,y,z) in the patient based coordinate system described in C.7.6.2.1.1 which is normal to plane of Contour Data (3006,0050), describing direction and magnitude of the offset (in mm) of each point of the central plane of a contour slab from the corresponding original point of Contour Data (3006,0050). See C.8.8.6.2. Usage: Not used
>>Number of Contour Points	(3006,0046)	1C	Number of points (triplets) in Contour Data (3006,0050). Required if Contour Sequence (3006,0040) is sent. Usage: Used and written.
>>Contour Data	(3006,0050)	1C	Sequence of (x, y, z) triplets defining a contour in the patient based coordinate system. Required if Contour Sequence (3006,0040) is sent. Usage: Used and written.

A.7.12 RT Dose ROI Module

NOT USED

A.7.13 RT ROI Observations Module

Attribute Name	Tag	Type	Attribute Description
RT ROI Observations Sequence	(3006,0080)	1	Introduces sequence of observations related to ROIs defined in the ROI Module. One or more items may be included in this sequence. Usage: Used and written. Requirement: If structure set is present, at least one RT ROI Observations is present in structure set
>Observation Number	(3006,0082)	1	Identification number of the Observation. The value of Observation Number (3006,0082) shall be unique within the RT ROI Observations Sequence (3006,0080). Usage: Used and written
>Referenced ROI Number	(3006,0084)	1	Uniquely identifies the referenced ROI described in the Structure Set ROI Sequence (3006,0020). Usage: Used and written
>ROI Observation Label	(3006,0085)	3	User-defined label for ROI Observation. Usage: Used and written.
>ROI Observation Description	(3006,0088)	3	User-defined description for ROI Observation. Usage: Not used.
>RT Related ROI Sequence	(3006,0030)	3	Introduces sequence of significantly related ROIs, e.g. CTVs contained within a PTV. One or more items may be included in this sequence. Usage: Used and written
>>Referenced ROI Number	(3006,0084)	1C	Uniquely identifies the related ROI described in the Structure Set ROI Sequence (3006,0020). Required if RT Related ROI Sequence (3006,0030) is sent.

Attribute Name	Tag	Type	Attribute Description
			Usage: Used and written
>>RT ROI Relationship	(3006,0033)	3	Relationship of referenced ROI with respect to referencing ROI. Defined Terms: SAME = ROIs represent the same entity ENCLOSED = referenced ROI completely encloses referencing ROI ENCLOSING = referencing ROI completely encloses referenced ROI Usage: Not used.
>RT ROI Identification Code Sequence	(3006,0086)	3	Introduces sequence containing Code used to identify ROI. If this sequence is included, only one item shall be present. Baseline Context ID Number = 96. See Section 5.3 for further explanation. Usage: Not used
>Related RT ROI Observations Sequence	(3006,00A0)		Introduces sequence of related ROI Observations. One or more items may be included in this sequence. Usage: Not used
>RT ROI Interpreted Type	(3006,00A4)	2	Type of ROI. Defined Terms: EXTERNAL = external patient contour PTV = Planning Target Volume (as defined in ICRU50) CTV = Clinical Target Volume (as defined in ICRU50) GTV = Gross Tumor Volume (as defined in ICRU50) TREATED_VOLUME = Treated Volume (as defined in ICRU50) IRRAD_VOLUME = Irradiated Volume (as defined in ICRU50) BOLUS = patient bolus to be used for external beam therapy AVOIDANCE = region in which dose is to be minimized ORGAN = patient organ MARKER = patient marker REGISTRATION = registration ROI ISOCENTER = treatment isocenter to be used for external beam therapy CONTRAST_AGENT = volume into which a contrast agent has been injected CAVITY = patient anatomical cavity BRACHY_CHANNEL = brachytherapy channel BRACHY_ACCESSORY = brachytherapy accessory device BRACHY_SRC_APP = brachytherapy source applicator BRACHY_CHNL_SHLD = brachytherapy channel shield Usage: Used and written. On save, store: In case ROI is reference point, set as ISOCENTER. In case of isocenter, set as MARKER.
>ROI Interpreter	(3006,00A6)	2	Name of person performing the interpretation. Usage: Not used
> Material ID	(300A,00E1)	3	User-supplied identifier for ROI material. Usage: Not used
>ROI Physical Properties Sequence	(3006,00B0)	3	Introduces sequence describing physical properties associated with current ROI interpretation. One or more items may be included in this sequence. Usage: Not used.

Attribute Name	Tag	Type	Attribute Description
>>ROI Physical Property	(3006,00B2)	1C	Physical property specified by ROI Physical Property Value (3006,00B4). Required if ROI Physical Properties Sequence (3006,00B0) is sent. Defined Terms: REL_MASS_DENSITY = mass density relative to water REL_ELEC_DENSITY = electron density relative to water EFFECTIVE_Z = effective atomic number EFF_Z_PER_A = effective ratio of atomic number to mass (AMU -1)
>>ROI Physical Property Value	(3006,00B4)	1C	User-assigned value for physical property. Required if ROI Physical Properties Sequence (3006,00B0) is sent.

A.7.14 RT General Plan Module

Attribute Name	Tag	Type	Attribute Description
RT Plan Label	(300A,0002)	1	User-defined label for treatment plan. Usage: Displayed and Modified by *syngo* RT Therapist as Plan Name.
RT Plan Name	(300A,0003)	3	User-defined name for treatment plan. Usage: Not used
RT Plan Description	(300A,0004)	3	User-defined description for treatment plan. Usage: Displayed and Modified by *syngo* RT Therapist
Instance Number	(0020,0013)	3	A number that identifies this object instance. Usage: Used by *syngo* RT Therapist.
Operator's Name	(0008,1070)	2	Name of operator(s) creating treatment plan. Usage: Displayed and Modified by *syngo* RT Therapist on plan modification. This attribute contains the temporary user information. If the temporary user is not logged in, the primary user information is stored here. Refer to Section Operator Name Encoding in *syngo* RT Therapist.
RT Plan Date	(300A,0006)	2	Date treatment plan was last modified. Usage: Displayed and modified on plan modification.
RT Plan Time	(300A,0007)	2	Time treatment plan was last modified. Usage: Displayed and modified on plan modification
Treatment Protocols	(300A,0009)	3	Planned treatment protocols. Usage: Displayed and modified by *syngo* RT Therapist.
Treatment Intent	(300A,000A)	3	Intent of this course of treatment. Defined Terms: CURATIVE PALLIATIVE PROPHYLACTIC Usage: Displayed and Modified by *syngo* RT Therapist
Treatment Sites	(300A,000B)	3	Planned treatment sites. Usage: Not used
RT Plan Geometry	(300A,000C)	1	Describes whether RT Plan is based on patient or treatment device geometry. Defined Terms: PATIENT = RT Structure Set exists

Attribute Name	Tag	Type	Attribute Description
			TREATMENT_DEVICE = RT Structure Set does not exist Usage: Used and written. When *syngo* RT Therapist generates a plan, this attribute is always 'TREATMENT_DEVICE'.
Referenced Structure Set Sequence	(300C,0060)	1C	Introduces sequence of one Class/Instance pair - describing instance of RT Structure Set on which the RT Plan is based. Only a single item shall be permitted in this sequence. Required if RT Plan Geometry (300A,000C) is PATIENT. Usage: Used and written.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Structure Set Sequence (300C,0060) is sent. Usage: Used and written.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Structure Set Sequence (300C,0060) is sent. Usage: Used and written.
Referenced Dose Sequence	(300C,0080)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Dose (for grids and named/unnamed point doses). One or more items may be included in this sequence. Usage: Not used
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Dose Sequence (300C,0080) is sent.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Dose Sequence (300C,0080) is sent.
Referenced RT Plan Sequence	(300C,0002)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Plan. One or more items may be included in this sequence. Usage: Used in *syngo* RT Therapist (See Plan Versioning in *syngo* RT Therapist)
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent. Usage: Used and written
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent. Usage: Used and written
>RT Plan Relationship	(300A,0055)	1C	Relationship of referenced plan with respect to current plan. Required if Referenced RT Plan Sequence (300C,0002) is sent. Defined Terms: PRIOR = plan delivered prior to current Treatment Usage: Ignored ALTERNATIVE = alternative plan prepared for current treatment Usage: Ignored PREDECESSOR = plan used in derivation of current plan Usage: Written and used by *syngo* RT Therapist. Used to maintain Plan versioning within *syngo* RT

Attribute Name	Tag	Type	Attribute Description
			Therapist. (See Plan Versioning in *syngo* RT Therapist)
Completed_Plan	(See Appendix A)	3	This flag is used to tag the plan as completed. If this attribute is not present, the plan is assumed to be ON_TREATMENT. Defined Terms: COMPLETED ON_TREATMENT
RT_Plan_Checksum	(See Appendix A)	3	This field contains the CRC checksum for the RT Plan.
Late Resumption Notification	(See Appendix A)	3	The attribute defines if the user shall be notified about incomplete fractions upon patient load. The enumerated values are: LR_DO_NOT_NOTIFY LR_NOTIFY_USER
RT_BEAMS_APPROVAL	(See Appendix A)	3	This attribute defines that Therapists approved the beam parameters. This attribute is defined on plan level and only in plans imported to *syngo* RT Therapist.
RT_SITE_APPROVAL	(See Appendix A)	3	This attribute defines that Oncologist approved the prescription.

A.7.14.1 Plan Versioning in *syngo* RT Therapist

Treatment plans that have been modified have to be saved as a new version (with a new UID) to enable DICOM transfer of the new version of the plan. In order to maintain the link with the original plan, *syngo* RT Therapist maintains a reference to the previous version of the plan using the RT General Plan's Referenced RT Plan Sequence's PREDECESSOR relationship.

In this manner, all plans derived from one another are daisy-chained together so that it is possible to track the treatment status across all previous versions. Only the latest version of a plan is loaded into *syngo* RT Therapist.

A.7.14.1.1 Label-based Plan Version Identification

Additionally, all plan chains with matching RT Plan Label ((300A,0002) shall be grouped together and the plan with the latest date-time (viz. RT Plan Date (300A,0006), RT Plan Time (300A,0007)) shall be identified as the latest version of the plan that is loaded into *syngo* RT Therapist.

A.7.14.1.2 Conditions for Creating a New Version of a Plan

A new version implies the creation a new RT Plan object with a different UID. The following conditions are used to optimize the number of individual plan objects generated within a single session by *syngo* RT Therapist:

- First edit on load: A new plan version is always created on the first edit after the patient is loaded into the application UI.
- Transferred check: If the latest plan version has not been transferred out of the current node/transferred-in from an external DICOM node, then editing the plan will not generate a new version of the plan.
- Delivery of plan: If the latest version of the plan has been treated, then the next edit to this plan always generates a new plan version.

A.7.14.2 Operator Name Encoding in *syngo* RT Therapist

syngo RT Therapist writes user information in the format userid@domain. This applies to the following attributes

- Operator's Name (0008,1070)
- Reviewer Name (300E,0008)

A.7.14.3 Approval Module

Attribute Name	Tag	Type	Attribute Description
Approval Status	(300E,0002)	1	Approval status at the time the SOP Instance was created. Enumerated Values: APPROVED = Reviewer recorded that object met an implied criterion. These plans are loaded and can be delivered. UNAPPROVED = No review of object has been recorded. These plans are loaded by cannot be delivered till they are APPROVED. REJECTED = Reviewer recorded that object failed to meet an implied criterion. *syngo* RT Therapist does not load plans with approval status “REJECTED”. Usage: All three enumerated values are read and written by *syngo* RT Therapist as described above.
Review Date	(300E,0004)	2C	Date on which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED. Usage: Displayed and written by *syngo* RT Therapist.
Review Time	(300E,0005)	2C	Time at which object was reviewed. Required if Approval Status (300E,0002) is APPROVED or REJECTED. Usage: Displayed and written by *syngo* RT Therapist.
Reviewer Name	(300E,0008)	2C	Name of person who reviewed object. Required if Approval Status (300E,0002) is APPROVED or REJECTED. Usage: Displayed and written by *syngo* RT Therapist. Refer to Section Operator Name Encoding in *syngo* RT Therapist.

A.7.15 RT Prescription Module

Attribute Name	Tag	Type	Attribute Description
Prescription Description	(300A,000E)	3	User-defined description of treatment prescription. Usage: Displayed and modified by *syngo* RT Therapist.
Dose Reference Sequence	(300A,0010)	3	Introduces sequence of Dose References. One or more items may be included in this sequence. Usage: Used by *syngo* RT Therapist
>Dose Reference Number	(300A,0012)	1C	Identification number of the Dose Reference. The value of Dose Reference Number (300A,0012) shall be unique within the RT Plan in which it is created. Required if Dose Reference Sequence (300A, 0012) is sent. Usage: Used by *syngo* RT Therapist
>Dose Reference Structure Type	(300A,0014)	1C	Structure type of Dose Reference. Required if Dose Reference Sequence (300A,0010) is sent. Defined Terms: POINT = dose reference point specified as ROI VOLUME = dose reference volume specified as ROI COORDINATES = point specified by Dose Reference Point Coordinates (300A,0018) SITE = dose reference clinical site.

Attribute Name	Tag	Type	Attribute Description
			Usage: Used and written by *syngo* RT Therapist. SITE - if Dose Reference Type = TARGET VOLUME – if Dose Reference Type = ORGAN_AT_RISK
>Dose Reference Description	(300A,0016)	3	User-defined description of Dose Reference. Usage: Uniquely identifies the treatment site name. (See Note 1.)
>Referenced ROI Number	(3006,0084)	1C	Uniquely identifies ROI representing the dose reference specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module. Required if Dose Reference Structure Type (300A,0014) is POINT or VOLUME and Dose Reference Sequence (300A,0010) is sent. Usage: Not used by *syngo* RT Therapist
>Dose Reference Point Coordinates	(300A,0018)	1C	Coordinates (x,y,z) of Reference Point in the patient based coordinate system described in C.7.6.2.1.1 (mm). Required if Dose Reference Structure Type (300A,0014) is COORDINATES and Dose Reference Sequence (300A,0010) is sent. Usage: Not used by *syngo* RT Therapist
>Nominal Prior Dose	(300A,001A)	3	Dose (in Gy) from prior treatment to this Dose Reference (e.g. from a previous course of treatment). Usage: Used and written.
>Dose Reference Type	(300A,0020)	1C	Type of Dose Reference. Required if Dose Reference Sequence (300A,0010) is sent. Defined Terms: TARGET = treatment target (corresponding to GTV, PTV, or CTV in ICRU50) ORGAN_AT_RISK = Organ at Risk (as defined in ICRU50) Usage: Used by *syngo* RT Therapist
>Constraint Weight	(300A,0021)	3	Relative importance of satisfying constraint where high values represent more important constraints. Usage: Not used
>Delivery Warning Dose	(300A,0022)	3	The dose (in Gy) which when reached or exceeded should cause some action to be taken. Usage: Used by *syngo* RT Therapist
>Delivery Maximum Dose	(300A,0023)	3	The maximum dose (in Gy) which can be delivered to the dose reference. Usage: Used by *syngo* RT Therapist
>Target Minimum Dose	(300A,0025)	3	Minimum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) is TARGET. Usage: Not used
>Target Prescription Dose	(300A,0026)	3	Prescribed dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) is TARGET. Usage: Used by *syngo* RT Therapist
>Target Maximum Dose	(300A,0027)	3	Maximum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) is TARGET. Usage: Used by *syngo* RT Therapist
>Target Underdose Volume Fraction	(300A,0028)	3	Maximum permitted fraction (in percent) of Target to receive less than the Target Prescription Dose if Dose Reference Type (300A,0020) is TARGET and Dose Reference Structure Type (300A,0014) is VOLUME. Usage: Not used

Attribute Name	Tag	Type	Attribute Description
>Organ at Risk Full-volume Dose	(300A,002A)	3	Maximum dose (in Gy) to entire Dose Reference if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME. Usage: Not used
>Organ at Risk Limit Dose	(300A,002B)	3	Maximum permitted dose (in Gy) to any part of Dose Reference if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME. Usage: Not used
>Organ at Risk Maximum Dose	(300A,002C)	3	Maximum dose (in Gy) to non-overdosed part of Dose Reference if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME. Usage: Not used
>Organ at Risk Overdose Volume Fraction	(300A,002D)	3	Maximum permitted fraction (in percent) of the Organ at Risk to receive more than the Organ at Risk Maximum Dose if Dose Reference Type (300A,0020) is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) is VOLUME. Usage: Not used
Delivery_Warning_Dose_ Description	(See Appendix A)	3	Description of action to be taken when Delivery Warning Dose level is exceeded.
Lead_Dose	(See Appendix A)	3	Defines the point when the user will be notified about approaching warning dose alert.

Note 1: Dose Reference Description attribute:

The dose reference description (300A, 0016) is expected to be the ROI name or the name of an equivalent site that the dose reference refers to. The description is also set within the Treatment Summary Calculated Dose Reference Sequence in the RT Treatment Summary Record module.

A.7.16 RT Tolerance Tables Module

Attribute Name	Tag	Type	Attribute Description
Tolerance Table Sequence	(300A,0040)	3	Introduces sequence of tolerance tables to be used for delivery of treatment plan. One or more items may be included in this sequence. Usage: Used and modified by *syngo* RT Therapist.
>Tolerance Table Number	(300A,0042)	1C	Identification number of the Tolerance Table. The value of Tolerance Table Number (300A,0042) shall be unique within the RT Plan in which it is created. Required if Tolerance Table Sequence (300A,0040) is sent. Usage: Used within RT Beams as an index to a particular tolerance table.
>Tolerance Table Label	(300A,0043)	3	User-defined label for Tolerance Table. Usage: Used to reference a global tolerance table. See Section Local and Global Tolerance Tables.

Attribute Name	Tag	Type	Attribute Description
>Gantry Angle Tolerance	(300A,0044)	3	Maximum permitted difference (in degrees) between planned and delivered Gantry Angle. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>Beam Limiting Device Angle Tolerance	(300A,0046)	3	Maximum permitted difference (in degrees) between planned and delivered Beam Limiting Device Angle. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>Beam Limiting Device Tolerance Sequence	((300A,0048)	3	Introduces sequence of beam limiting device (collimator) tolerances. One or more items may be included in this sequence. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>>RT Beam Limiting Device Type	(300A,00B8)	1C	Type of beam limiting device (collimator). Required if Beam Limiting Device Tolerance Sequence (300A,0040) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>>Beam Limiting Device Position Tolerance	(300A,004A)	1C	Maximum permitted difference (in mm) between planned and delivered leaf (element) or jaw positions for current beam limiting device (collimator). Required if Beam Limiting Device Tolerance Sequence (300A,0040) is sent. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>Patient Support Angle Tolerance	(300A,004C)	3	Maximum permitted difference (in degrees) between planned and delivered Patient Support Angle. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>Table Top Eccentric Angle Tolerance	(300A,004E)	3	Maximum permitted difference (in degrees) between planned and delivered Table Top Eccentric Angle. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>Table Top Vertical Position Tolerance	(300A,0051)	3	Maximum permitted difference (in mm) between planned and delivered Table Top Vertical Position. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.

Attribute Name	Tag	Type	Attribute Description
>Table Top Longitudinal Position Tolerance	(300A,0052)	3	Maximum permitted difference (in mm) between planned and delivered Table Top Longitudinal Position. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
>Table Top Lateral Position Tolerance	(300A,0053)	3	Maximum permitted difference (in mm) between planned and delivered Table Top Lateral Position. Usage: Used by *syngo* RT Therapist. Present only in local tolerance tables. See Section Local and Global Tolerance Tables.
SID_Tolerance	(See Appendix A)	3	Tolerance value for Source-to-Imager distance for MV flat panel
FlatPanel_LateralPos_ Tolerance	(See Appendix A)	3	Tolerance value for the lateral position of the MV flat panel
FlatPanel_LongitudinalPos_ Tolerance	(See Appendix A)	3	Tolerance value for the longitudinal position of the MV flat panel

A.7.16.1 Local and Global Tolerance Tables

Global (Default) DICOM RT Tolerance tables for the treatment machine attached to the workstation will be configured in each workstation. These global tolerance tables shall be identified using the *Tolerance Table Label* (300A, 0043) attribute.

If all attributes (including Type 3 attributes) are present and valid within an entry in the tolerance table sequence, *syngo* RT Therapist considers that the table as a local tolerance table. Note that in case of Beam Limiting Device Angle Tolerance, atleast one of the X tolerance ("MLCX", "X", or "ASYMX") and atleast one of the Y Tolerance ("MLCY", "Y", or "ASYMY") need to be present.

Currently, local tolerance tables are not supported and *syngo* RT Therapist always uses the Global Tolerance Tables.

A.7.16.2 Validation Rules for Tolerance Tables

- A tolerance table in the plan can be either a global or local tolerance table (See Section Local and Global Tolerance Tables).
- For a local tolerance table, all the DICOM RT attributes of the tolerance table that are read by *syngo* RT Therapist must be present. (See Section Local and Global Tolerance Tables)
- For a Global tolerance table, the ‘Tolerance Table Label’ of the table that is sent, must correspond to the tolerance table label of a Global Tolerance table.
- A table is considered invalid if it does not qualify as a local table and it’s ‘Tolerance Table Label’ does not match that of a tolerance table stored in the workstation’s global tolerance table list.

A.7.17 RT Patient Setup Module

Attribute Name	Tag	Type	Attribute Description
Patient Setup Sequence	(300A,0180)	1	Introduces sequence of patient setup data for current plan. One or more items may be included in this sequence. Usage: Read and modified by *syngo* RT Therapist RT Plan: The order of objects in the sequence is the order in which the setups are visualized.

Attribute Name	Tag	Type	Attribute Description
			RT Beams Treatment Record: Used to record the patient setup at which the patient was treated.
>Patient Setup Number	(300A,0182)	1	Identification number of the Patient Setup. The value of Patient Setup Number (300A,0182) shall be unique within the RT Plan in which it is created. Usage: Read by *syngo* RT Therapist RT Beams Treatment Record: The number which is referenced in the treatment Session Beam module of the beam that was treated with this setup.
>Patient Position	(0018,5100)	1C	Patient position descriptor relative to the equipment. Required if Patient Additional Position (300A,0184) is not present. Usage: Read and modified by *syngo* RT Therapist
>Patient Additional Position	(300A,0184)	1C	User-defined additional description of patient position. Required if Patient Position (0018,5100) is not present. Usage: Set to 'None specified' when a default setup is created. See Note 1.
>Fixation Device Sequence	(300A,0190)	3	Introduces sequence of Fixation Devices used in Patient Setup. One or more items may be included in this sequence. Usage: Not used.
>>Fixation Device Type	(300A,0192)	1C	Type of Fixation Device used during in Patient Setup. Required if Fixation Device Sequence (300A,0190) is sent. Defined Terms: BITEBLOCK, HEADFRAME, MASK, MOLD, CAST, HEADREST, BREAST_BOARD Usage: Not used.
>>Fixation Device Label	(300A,0194)	2C	User-defined label identifier for Fixation Device. Required if Fixation Device Sequence (300A,0190) is sent. Usage: Not used.
>>Fixation Device Description	(300A,0196)	3	User-defined description of Fixation Device. Usage: Not used.
>>Fixation Device Position	(300A,0198)	3	Position/Notch number of Fixation Device. Usage: Not used.
>Shielding Device Sequence	(300A,01A0)	3	Introduces sequence of Shielding Devices used in Patient Setup. One or more items may be included in this sequence. Usage: Not used.
>>Shielding Device Type	(300A,01A2)	1C	Type of Shielding Device used in Patient Setup. Required if Shielding Device Sequence (300A,01A0) is sent. Defined Terms: GUM, EYE, GONAD Usage: Not used.
>>Shielding Device Label	(300A,01A4)	2C	User-defined label for Shielding Device. Required if Shielding Device Sequence (300A,01A0) is sent. Usage: Not used.
>>Shielding Device Description	(300A,01A6)	3	User-defined description of Shielding Device. Usage: Not used.
>>Shielding Device Position	(300A,01A8)	3	Position/Notch number of Shielding Device. Usage: Not used.

Attribute Name	Tag	Type	Attribute Description
>Setup Technique	(300A,01B0)	3	Setup Technique used in Patient Setup. Defined Terms: ISOCENTRIC, FIXED_SSD, TBI, BREAST_BRIDGE, SKIN_APPOSITION Usage: Not used.
>Setup Technique Description	(300A,01B2)	3	User-defined description of Setup Technique. Usage: Read and modified by *syngo* RT Therapist
>Setup Device Sequence	(300A,01B4)	3	Introduces sequence of devices used for patient alignment in Patient Setup. One or more items may be included in this sequence. Usage: Not used.
>>Setup Device Type	(300A,01B6)	1C	Type of Setup Device used for Patient alignment. Required if Setup Device Sequence (300A,01B4) is sent. Defined Terms: LASER_POINTER, DISTANCE_METER, TABLE_HEIGHT, MECHANICAL_PTR, ARC Usage: Not used.
>>Setup Device Label	(300A,01B8)	2C	User-defined label for Setup Device used for patient alignment. Required if Setup Device Sequence (300A,01B4) is sent. Usage: Not used.
>>Setup Device Description	(300A,01BA)	3	User-defined description for Setup Device used for patient alignment. Usage: Not used.
>>Setup Device Parameter	(300A,01BC)	2C	Setup Parameter for Setup Device in appropriate IEC 61217 coordinate system. Units shall be mm for distances and angles for degrees. Required if Setup Device Sequence (300A,011B4) is sent. Usage: Not used.
>>Setup Reference Description	(300A,01D0)	3	User-defined description of Setup Reference used for patient alignment. Usage: Not used.
>Table Top Vertical Setup Displacement	(300A,01D2)	3	Vertical Displacement in IEC TABLE TOP coordinate system (in mm) relative to initial Setup Position, i.e. vertical offset between patient positioning performed using setup and treatment position. Usage: Read and modified by *syngo* RT Therapist (for relative table offset). Also see Table 11. RT Beams Treatment Record: Store the setup offsets that were delivered if any.
>Table Top Longitudinal Setup Displacement	(300A,01D4)	3	Longitudinal Displacement in IEC TABLE TOP coordinate system (in mm) relative to initial Setup Position, i.e. longitudinal offset between patient positioning performed using setup and treatment position. Usage: Read and modified by *syngo* RT Therapist (for relative table offset) Also See Table 11. RT Beams Treatment Record: Store the setup offsets that were delivered if any.
>Table Top Lateral Setup Displacement	(300A,01D6)	3	Lateral Displacement in IEC TABLE TOP coordinate system (in mm) relative to initial Setup Position, i.e. lateral offset between patient positioning performed using setup and treatment position. Usage: Read and modified by *syngo* RT Therapist (for relative table offset) Also See Table 11.

Attribute Name	Tag	Type	Attribute Description
			RT Beams Treatment Record: Store the setup offsets that were delivered if any.
Setup Name	(See Appendix A)	3	User-defined name for the patient setup. When a plan is imported from a TPS, it will not have a name assigned to the patient setup. A default setup name is assigned.on first load into *syngo* RT Therapist.
Additional_Setup_Instructions	(See Appendix A)	3	Used to store additional description of patient position if it exceeds DICOM specified 64 character limit.
Setup Image Sequence	(See Appendix A)	3	Sequence of Setup Photos. The first image in the sequence is considered as the 'default' setup photo. RT Plan: Used. RT Beams Treatment Record: Not used. One ore more items can be present in the sequence
>Setup Image Description	(See Appendix A)	3	User defined description for the setup image.
>Referenced SOP Class UID	(See Appendix A)	3	SOP class UID of the setup image
>Referenced SOP Instance UID	(See Appendix A)	3	SOP instance UID of the setup image.
Delivered Positioning Offsets: Lateral Longitudinal Vertical	(See Appendix A)	3	Used in RT Beams Treatment Record Only: Stores the positioning offsets if applied for this delivered setup.

Note: 1. Patient Additional Position: If, when a new plan is imported from a Treatment Planning System (TPS), no setup is associated with *one or more* Tx beams, a default setup is created for those beams. This default setup will have the '*Patient Additional Position*' attribute of the Patient Setup set to '*None specified*'. All other non-mandatory patient setup attributes will remain empty.

2. If there are no beams associated with a DICOM-valid setup that was received as part of an imported plan, it is assumed to be valid. (And is displayed as a setup without beams.)

A.7.18 RT Fraction Scheme Module

Attribute Name	Tag	Type	Attribute Description
Fraction Group Sequence	(300A,0070)	1	Introduces sequence of Fraction Groups in current Fraction Scheme. One or more items may be included in this sequence. Usage: Displayed and Modified by *syngo* RT Therapist. The order of objects in the sequence is the order in which the fraction groups are visualized.

Attribute Name	Tag	Type	Attribute Description
>Fraction Group Number	(300A,0071)	1	Identification number of the Fraction Group. The value of Fraction Group Number (300A,0071) shall be unique within the RT Plan in which it is created. Usage: Used by *syngo* RT Therapist.
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Patient Setup specified by Patient Setup Number (300A,0182) within Patient Setup Sequence (300A,0180) in RT Patient Setup Module. Usage: Used by *syngo* RT Therapist.
>Referenced Dose Sequence	(300C,0080)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Dose (for grids, isodose curves and named/unnamed point doses). One or more items may be included in this sequence. Usage: Not used
>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Dose Sequence (300C,0080) is sent. Usage: Not used.
>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Dose Sequence (300C,0080) is sent. Usage: Not used.
>Referenced Dose Reference Sequence	(300C,0050)	3	Introduces sequence of Dose References for the current Fraction Group. One or more items may be included in this sequence. Usage: Not used. Dose References from RT Prescription module are used.
>>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) within Dose Reference Sequence (300A,0010) in RT Prescription Module. Required if Referenced Dose Reference Sequence (300C,0050) is sent. Usage: Not used.
>>Constraint Weight	(300A,0021)	3	Relative importance of satisfying constraint, where high values represent more important constraints. Usage: Not used.
>>Delivery Warning Dose	(300A,0022)	3	The dose (in Gy) which when reached or exceeded should cause some action to be taken. Usage: Not used.
>>Delivery Maximum Dose	(300A,0023)	3	The maximum dose (in Gy), which can be delivered to the dose reference. Usage: Not used.
>>Target Minimum Dose	(300A,0025)	3	Minimum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET. Usage: Not used. Dose References from RT Prescription module used. Usage: Not used.
>>Target Prescription Dose	(300A,0026)	3	Prescribed dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET. Usage: Not used.
>>Target Maximum Dose	(300A,0027)	3	Maximum permitted dose (in Gy) to Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET. Usage: Not used.

Attribute Name	Tag	Type	Attribute Description
>>Target Underdose Volume Fraction	(300A,0028)	3	Maximum permitted fraction (in percent) of Target to receive less than the Target Prescription Dose (300A,0027) if Dose Reference Type (300A,0020) of referenced Dose Reference is TARGET and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME. Usage: Not used.
>>Organ at Risk Full-volume Dose	(300A,002A)	3	Maximum dose (in Gy) to entire Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME. Usage: Not used.
>>Organ at Risk Limit Dose	(300A,002B)	3	Maximum permitted dose (in Gy) to any part of Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME. Usage: Not used.
>>Organ at Risk Maximum Dose	(300A,002C)	3	Maximum dose (in Gy) to non-overdosed part of Dose Reference if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME. Usage: Not used.
>>Organ at Risk Overdose Volume Fraction	(300A,002D)	3	Maximum permitted fraction (in percent) of Organ at Risk to receive more than the Organ at Risk Maximum Dose if Dose Reference Type (300A,0020) of referenced Dose Reference is ORGAN_AT_RISK and Dose Reference Structure Type (300A,0014) of referenced Dose Reference is VOLUME. Usage: Not used.
>Number of Fractions Planned	(300A,0078)	2	Total number of treatments (Fractions) prescribed for current Fraction Group. Usage: Read and modified by *syngo* RT Therapist
>Number of Fraction Pattern Digits Per Day	(300A,0079)	3	Number of digits in Fraction Pattern (300A,007B) used to represent one day. Usage: Not used
>Repeat Fraction Cycle Length	(300A,007A)	3	Number of weeks needed to describe treatment pattern. Usage: Not used
>Fraction Pattern	(300A,007B)	3	String of 0's (no treatment) and 1's (treatment) describing treatment pattern. Length of string is 7 x Number of Fraction Pattern Digits Per Day x Repeat Fraction Cycle Length. Pattern shall start on a Monday. Usage: Not used
>Number of Beams	(300A,0080)	1	Number of Beams in current Fraction Group. If Number of Beams is greater then zero, Number of Brachy Application Setups shall equal zero. Usage: Used. Minimum 1.

Attribute Name	Tag	Type	Attribute Description
>Referenced Beam Sequence	(300C,0004)	1C	Introduces sequence of treatment beams in current Fraction Group. Required if Number of Beams (300A,0080) is greater than zero. One or more items may be included in this sequence. Usage: Referenced Beams can be created, deleted and modified. (See Referenced Beam Sequence)
>>Referenced Beam Number	(300C,0006)	1C	Uniquely identifies Beam specified by Beam Number (300A,00C0) within Beam Sequence (300A,00B0) in RT Beams Module. Required if Referenced Beam Sequence (300C,0004) is sent. Usage: Visualized. Modified when beams are deleted or created.
>>Beam Dose Specification Point	(300A,0082)	3	Coordinates (x,y,z) of point at which Beam Dose is specified in the patient based coordinate system Usage: Not Used.
>>Beam Dose	(300A,0084)	3	Dose (in Gy) at Beam Dose Specification Point (300A,0082) due to current Beam. Usage: Visualized and used for dose tracking.
>>Beam Meterset	(300A,0086)	3	Machine setting to be delivered for current Beam, specified in Monitor Units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3) (in RT Beams Module) for referenced Beam. Usage: Used and written by *syngo* RT Therapist. MUs might also be changed by *syngo* RT Therapist on change of portal imaging options. See Beam Meterset
>Number of Brachy Application Setups	(300A,00A0)	1	Number of Brachy Application Setups in current Fraction Group. If Number of Brachy Application Setups is greater then zero, Number of Beams (300A,0080) shall equal zero. Usage: Not used. Set to zero when a new fraction is created in *syngo* RT Therapist.
>Referenced Brachy Application Setup Sequence	(300C,000A)	1C	Introduces sequence of treatment Brachy Application Setups in current Fraction Group. Required if Number of Brachy Application Setups (300A,00A0) is greater than zero. One or more items may be included in this sequence. Usage: Not used
>>Referenced Brachy Application Setup Number	(300C,000C)	1C	Uniquely identifies Brachy Application Setup specified by Brachy Application Setup Number (300A,0234) within Brachy Application Setup Sequence (300A,0230) in RT Brachy Application Setups Module. Required if Referenced Brachy Application Setup Sequence (300C,000A) is sent. Usage: Not used
>>Brachy Application Setup Dose Specification Point	(300A,00A2)	3	Coordinates (x, y, z) of point in the patient based coordinate system described in C.7.6.2.1.1 at which Brachy Application Setup Dose 300A,00A4) is specified (mm). Usage: Not used
>>Brachy Application Setup Dose	(300A,00A4)	3	Dose (in Gy) at Brachy Application Setup Dose Specification Point (300A,00A2) due to current Brachy Application Setup. Usage: Not used
Fraction_Group_Name	(See Appendix A)		Display name for the Fraction Group
Fraction_Time_Interval	(See Appendix A)		The minimum time in hours between fractions.

Attribute Name	Tag	Type	Attribute Description
Fractions_Per_Week	(See Appendix A)		The number of scheduled treatments of this fraction per week.

A.7.18.1 Referenced Beam Sequence

All beams in the plan should be referenced by at least one fraction group.

The order of beams in the referenced beam sequence in the fraction group represents, the order in which the beams will be visualized under that fraction group. (A.7.19.4)

If a plan does not contain any Fraction groups, then *syngo* RT Therapist creates a default fraction group that shall contain all the beams in the RT Plan.

A.7.18.2 Beam Meterset

1. *Verification images segments* MUs are included in the Beam Meterset (300A,0086).
2. Replicated Beams: If multiple fraction groups reference the same beam, *syngo* RT Therapist requires that the referenced beams have the same Beam Meterset value. Otherwise, the plan is considered undeliverable.

A.7.18.3 Consistency Requirements for Fraction Groups

- A fraction group cannot be empty i.e. does not reference any beam.
- If a plan contains at least one fraction group, *syngo* RT Therapist shall check that all RT Beams in the plan are referenced by at least one Fraction group. If there are any orphaned/unreferenced beams (except Setup beams), the RT Plan is considered inconsistent and shall not be loaded into *syngo* RT Therapist.

A.7.19 RT Beams Module

Attribute Name	Tag	Type	Attribute Description
Beam Sequence	(300A,00B0)	1	Introduces sequence of treatment beams for current RT Plan. One or more items may be included in this sequence. Usage: Used by *syngo* RT Therapist.
>Beam Number	(300A,00C0)	1	Identification number of the Beam. The value of Beam Number (300A,00C0) shall be unique within the RT Plan in which it is created. Usage: Displayed by *syngo* RT Therapist.
>Beam Name	(300A,00C2)	3	User-defined name for Beam. Usage: Displayed and modified by *syngo* RT Therapist
>Beam Description	(300A,00C3)	3	User-defined description for Beam. Usage: Displayed and modified by *syngo* RT Therapist
>Beam Type	(300A,00C4)	1	Motion characteristic of Beam Enumerated Values: STATIC = All Control Point Sequence (300A,0111) attributes remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134). DYNAMIC = One or more Control Point Sequence (300A,0111) attributes change between one or more consecutive pairs of control points with changing Cumulative Meterset Weight (300A,0134). Usage: DYNAMIC Not used except for ARC and Cone beams. Used to interpret *syngo* RT Therapist Beam Type. See Section A.7.19.1
>Radiation Type	(300A,00C6)	2	Particle type of Beam. Defined Terms: PHOTON, ELECTRON, NEUTRON, PROTON Usage: Displayed and modified by *syngo* RT Therapist. Can be only PHOTON or ELECTRON.
>High-Dose Technique Type	(300A,00C7)	1C	Type of high-dose treatment technique. Defined Terms: NORMAL = Standard treatment TBI = Total Body Irradiation HDR = High Dose Rate Required if treatment technique requires a dose that would normally require overriding of treatment machine safety controls. Usage: Not used.

Attribute Name	Tag	Type	Attribute Description
>Treatment Machine Name	(300A,00B2)	2	User-defined name identifying treatment machine to be used for beam delivery. Usage: Displayed and written by *syngo* RT Therapist.
>Manufacturer	(0008,0070)	3	Manufacturer of the equipment to be used for beam delivery. Usage: Not used
>Institution Name	(0008,0080)	3	Institution where the equipment is located that is to be used for beam delivery. Usage: Not used
>Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment is located that is to be used for beam delivery. Usage: Not used
>Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment is located that is to be used for beam delivery. Usage: Not used
>Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model name of the equipment that is to be used for beam delivery. Usage: Not used
>Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that is to be used for beam delivery. Usage: Not used
>Primary Dosimeter Unit	(300A,00B3)	3	Measurement unit of machine dosimeter. Enumerated Values: MU = Monitor Unit, MINUTE = minute Usage: Always MU
>Referenced Tolerance Table Number	(300C,00A0)	3	Uniquely identifies Tolerance Table specified by Tolerance Table Number (300A,0042) within Tolerance Table Sequence in RT Tolerance Tables Module. These tolerances are to be used for verification of treatment machine settings. Usage: Used and modified by *syngo* RT Therapist
>Source-Axis Distance	(300A,00B4)	3	Radiation source to Gantry rotation axis distance of the equipment that is to be used for beam delivery (mm). Usage: Used by *syngo* RT Therapist
>Beam Limiting Device Sequence	(300A,00B6)	1	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) sets. One or more items may be included in this sequence. Usage: Used and modified by *syngo* RT Therapist
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC

Attribute Name	Tag	Type	Attribute Description
			X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction Usage: Used by *syngo* RT Therapist
>>Source to Beam Limiting Device Distance	(300A,00BA)	3	Radiation source to beam limiting device (collimator) distance of the equipment that is to be used for beam delivery (mm). Usage: Not used
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws). Usage: Used and written by *syngo* RT Therapist
>>Leaf Position Boundaries	(300A,00BE)	2C	Boundaries of beam limiting device (collimator) leaves (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e. X-axis for MLCY, Y-axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if Beam Limiting Device Sequence (300A,00B6) is sent and RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY. Usage: Read and modified in *syngo* RT Therapist
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Patient Setup to be used for current beam, specified by Patient Setup Number (300A,0182) within Patient Setup Sequence of RT Patient Setup Module. Usage: Read and modified in *syngo* RT Therapist
>Referenced Reference Image Sequence	(300C,0042)	3	Introduces sequence of reference images used for validation of current beam. One or more items may be included in this sequence. Usage: Read and written in *syngo* RT Therapist
>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Reference Image Sequence (300C,0042) is sent. Usage: Read and written in *syngo* RT Therapist
>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Reference Image Sequence (300C,0042) is sent. Usage: Read and written in *syngo* RT Therapist

Attribute Name	Tag	Type	Attribute Description
>>Reference Image Number	(300A,00C8)	1C	Uniquely identifies Reference Image within Referenced Reference Image Sequence (300A,0042). Required if Referenced Reference Image Sequence (300A,0042) is sent. Usage: Read and written in *syngo* RT Therapist. Unique integer identifier set.
>>Start Cumulative Meterset Weight	(300C,0008)	3	Cumulative Meterset Weight within current Beam at which image acquisition starts. Usage: Not used by *syngo* RT Therapist
>>End Cumulative Meterset Weight	(300C,0009)	3	Cumulative Meterset Weight within current Beam at which image acquisition ends. Usage: Not used by *syngo* RT Therapist
>Planned Verification Image Sequence	(300A,00CA)	3	Introduces sequence of planned verification images to be acquired during current beam. One or more items may be included in this sequence. Usage: For interpretation in *syngo* RT Therapist, see Planned Verification Image Sequence)
>>Start Cumulative Meterset Weight	(300C,0008)	3	Cumulative Meterset Weight within current Beam at which image acquisition will start. Usage: Cumulative meterset weight of the control point at which image capture starts. See Planned Verification Image Sequence).
>>Meterset Exposure	(3002,0032)	3	Meterset duration over which image is to be acquired, specified in Monitor units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3). Usage: Not used.
>>End Cumulative Meterset Weight	(300C,0009)	3	Cumulative Meterset Weight within current Beam at which image acquisition will end. Usage: Cumulative meterset weight of the control point at which image capture ends. See Planned Verification Image Sequence).
>>RT Image Plane	(3002,000C)	3	Describes whether or not image plane is normal to beam axis. Enumerated Values: NORMAL = image plane normal to beam axis NON_NORMAL = image plane non-normal to beam axis Usage: Always NORMAL.
>>X-Ray Image Receptor Angle	(3002,000E)	3	X-Ray Image Receptor Angle i.e. orientation of IEC X-RAY IMAGE RECEPTOR coordinate system with respect to IEC GANTRY coordinate system (degrees). Usage: Always 0 degrees

Attribute Name	Tag	Type	Attribute Description
>>RT Image Orientation	(3002,0010)	3	The direction cosines of the first row and the first column with respect to the IEC X-RAY IMAGE RECEPTOR coordinate system. Usage: Not used.
>>RT Image Position	(3002,0012)	3	The x and y coordinates (in mm) of the upper left hand corner (first pixel transmitted) of the image, in the IEC X-RAY IMAGE RECEPTOR coordinate system. Usage: Displayed and modfiied by *syngo* RT Therapist. This attribute is used to store the values of the EPID X and Y position if imaging is planned with a EPID.
>>RT Image SID	(3002,0026)	3	Radiation machine source to image plane distance (mm). Usage: Displayed and modified by *syngo* RT Therapist.
>>Imaging Device-Specific Acquisition Parameters	(300A,00CC)	3	User-specified device-specific parameters, which describe how the imager will acquire the image. Usage: Used. Stores the following values as key value pairs: 1) Portal Imaging Device Type: Key: DEVICE Values: FLAT_PANEL, CAMERA, FILM, FLAT_PANEL_KV. 2) Protocol Name: Key: PROTOCOL Values: Any String. (upto 54 characters in length.) 3) ARC increment: Key: ARC_INCREMENT Value Type: integer 4) Clipping enabled Key: CLIPPING Value: 0 or 1. 5.) Accessories for the imaging segment Key: ACC Value: Accessory code for this segment. 6.) Automatically apply the CLAHE filter: Key: APPLY_CLAHE Value : 0 or 1 7.) Save all frames of a continous exposure: Key: SAVE_FRAMES Value: 0 or 1 8.) Integrate every frame: Key: INTEGRATE_EVERY Value: Numeric Integrate Every nth frame. This field stores the value of n, indicating how many sub-frames need to be

Attribute Name	Tag	Type	Attribute Description
			integrated and stored as one 9.) Automatic deployment of the flat panel. Key: AUTO_DEPLOY Value: 0 or 1. 10.) Cine image is to be acquired Key: CINE_MODE Value: 0 or 1 11.) Patient size denomination Key: PATIENT_SIZE Value: Numeric 12.) Organ program used: Key: ORGAN_PROGRAM Value: String description 13.) Patient anatomy Key: PATIENT_ANATOMY Value: String description 14.) Frame rate for a cine-acquisition in frames/second Key: CINE_FRAMERATE Value: Numeric 15.) Duration of the cine acquisition in seconds Key: CINE_DURATION Value: Numeric 16) Number of Pixels for the Portal Image Key: IMAGE_SIZE_X, IMAGE_SIZE_Y Value: Numeric
>>Referenced Reference Image Number	(300C,0007)	3	Uniquely identifies Reference Image to which planned verification image is related, specified by Reference Image Number (300A,00C8) within Referenced Reference Image Sequence (300A,0042). Usage: Used by *syngo* RT Therapist if present.
>Treatment Delivery Type	(300A,00CE)	3	Delivery Type of treatment. Defined Terms: TREATMENT = normal patient treatment. Set in new treatment beams. OPEN_PORTFILM = portal image acquisition with open field – NOT USED. TRMT_PORTFILM = portal image acquisition with treatment port – NOT USED. CONTINUATION = continuation of interrupted treatment – NOT USED SETUP = Used for 2D Position verification, CBCT and Setup Beams. Usage: Used and modified by *syngo* RT Therapist.
>Referenced Dose Sequence	(300C,0080)	3	Introduces sequence of related SOP Class/Instance pairs describing related instances of RT Dose (for grids, isodose curves, and named/unnamed point doses). One or more items may be included in

Attribute Name	Tag	Type	Attribute Description
			this sequence. Usage: Not used.
>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Dose Sequence (300C,0080) is sent. Usage: Not used.
>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Dose Sequence (300C,0080) is sent. Usage: Not used.
>Number of Wedges	(300A,00D0)	1	Number of wedges associated with current Beam. Usage: Maximum 1 wedge allowed. See Accessories
>Wedge Sequence	(300A,00D1)	1C	Introduces sequence of treatment wedges. Required if Number of Wedges (300A,00D0) is non-zero. One or more items may be included in this sequence. Usage: Used and modified by *syngo* RT Therapist
>>Wedge Number	(300A,00D2)	1C	Identification number of the Wedge. The value of Wedge Number (300A,00D2) shall be unique within the Beam in which it is created. Required if Wedge Sequence (300A,00D1) is sent. Usage: Used and modified by *syngo* RT Therapist.
>>Wedge Type	(300A,00D3)	2C	Type of wedge (if any) defined for Beam. Required if Wedge Sequence (300A,00D1) is sent. Defined Terms: STANDARD = standard (static) wedge DYNAMIC = moving beam limiting device (collimator) jaw simulating wedge MOTORIZED = single wedge which can be removed from beam remotely Usage: Not used
>>Wedge ID	(300A,00D4)	3	User-supplied identifier for Wedge. Usage: Read and modified by *syngo* RT Therapist
>> Accessory Code	(300A,00F9)	3	An identifier for the accessory intended to be read by a device such as a bar-code reader. Usage: Not used
>>Wedge Angle	(300A,00D5)	2C	Nominal wedge angle (degrees). Required if Wedge Sequence (300A,00D1) is sent. Usage: Not used
>>Wedge Factor	(300A,00D6)	2C	Nominal wedge factor under machine calibration conditions at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the Control Point Sequence (300A,0111). Required if Wedge Sequence (300A,00D1) is sent.

Attribute Name	Tag	Type	Attribute Description
			Usage: Not used
>>Wedge Orientation	(300A,00D8)	2C	Orientation of wedge, i.e. orientation of IEC WEDGE FILTER coordinate system with respect to IEC BEAM LIMITING DEVICE coordinate system (degrees). Required if Wedge Sequence (300A,00D1) is sent. Usage: Not used
>>Source to Wedge Tray Distance	(300A,00DA)	3	Radiation source to wedge tray attachment edge distance (in mm) for current wedge. Usage: Not used
>Number of Compensators	(300A,00E0)	1	Number of compensators associated with current Beam. Usage: Not Used.
>Total Compensator Tray Factor	(300A,00E2)	3	Compensator Tray transmission factor (between 0 and 1), at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the Control Point Sequence (300A,0111). Usage: Not used.
>Compensator Sequence	(300A,00E3)	1C	Introduces sequence of treatment compensators. Required if Number of Compensators (300A,00E0) is non-zero. One or more items may be included in this sequence. Usage: Not used.
>>Compensator Number	(300A,00E4)	1C	Identification number of the Compensator. The value of Compensator Number (300A,00E4) shall be unique within the Beam in which it is created. Required if Number of Compensators (300A,00E0) is non-zero. Usage: Not used.
>>Compensator Type	(300A,00EE)	3	Type of compensator (if any). Defined Terms: STANDARD = physical (static) compensator DYNAMIC = moving Beam Limiting Device (collimator) simulating physical compensator Usage: Not used
>>Material ID	(300A,00E1)	2C	User-supplied identifier for material used to manufacture Compensator. Required if Number of Compensators (300A,00E0) is non-zero. Usage: Not used.
>>Compensator ID	(300A,00E5)	3	User-supplied identifier for compensator. Usage: Not used.
>> Accessory Code	(300A,00F9)	3	An identifier for the accessory intended to be read by a device such as a bar-code reader. Usage: Not used
>>Source to Compensator Tray Distance	(300A,00E6)	2C	Radiation source to compensator tray attachment edge distance (in mm) for current compensator. Required if

Attribute Name	Tag	Type	Attribute Description
			Compensator Sequence (300A,00E3) is sent. Usage: Not used.
>>Compensator Rows	(300A,00E7)	1C	Number of rows in the compensator. Required if Compensator Sequence (300A,00E3) is sent. Usage: Not used
>>Compensator Columns	(300A,00E8)	1C	Number of columns in the compensator. Required if Compensator Sequence (300A,00E3) is sent. Usage: Not used
>>Compensator Pixel Spacing	(300A,00E9)	1C	Physical distance (in mm) between the center of each pixel projected onto machine isocentric plane. Specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing. Required if Compensator Sequence (300A,00E3) is sent. Usage: Not used
>>Compensator Position	(300A,00EA)	1C	The x and y coordinates of the upper left hand corner (first pixel transmitted) of the compensator, projected onto the machine isocentric plane in the IEC BEAM LIMITING DEVICE coordinate system (mm). Required if Compensator Sequence (300A,00E3) is sent. Usage: Not used
>>Compensator Transmission Data	(300A,00EB)	1C	A data stream of the pixel samples which comprise the compensator, expressed as broad-beam transmission values (between 0 and 1) along a ray line passing through the pixel, at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the Control Point Sequence (300A,0111). The order of pixels sent is left to right, top to bottom, i.e., the upper left pixel is sent first followed by the remainder of the first row , followed by the first pixel of the 2nd row, then the remainder of the 2nd row and so on) when viewed from the radiation source. Required if Compensator Sequence (300A,00E3) is sent and Material ID (300A,00E1) is zero-length. Usage: Not used
>>Compensator Thickness Data	(300A,00EC)	1C	A data stream of the pixel samples which comprise the compensator, expressed as thickness' (in mm) parallel to radiation beam axis. The order of pixels sent is left to right, top to bottom, i.e., the upper left pixel is sent first followed by the remainder of the first row, followed by the first pixel of the 2nd row, then the remainder of the 2nd row and so on) when viewed from the radiation source. Required if

Attribute Name	Tag	Type	Attribute Description
			Compensator Sequence (300A,00E3) is sent and Material ID (300A,00E1) is non-zero length. Usage: Not used
>Number of Boli	(300A,00ED)	1	Number of boli associated with current Beam. Usage: Not used. Set to 0 on write.
>Referenced Bolus Sequence	(300C,00B0)	1C	Introduces sequence of boli associated with Beam. Required if Number of Boli (300A,00ED) is non-zero. One or more items may be included in this sequence. Usage: Not used
>>Referenced ROI Number	(3006,0084)	1C	Uniquely identifies ROI representing the Bolus specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set in Referenced Structure Set Sequence (300C,0060) in RT General Plan Module. Required if Referenced Bolus Sequence (300A,00B0) is sent. Usage: Not used.
>Number of Blocks	(300A,00F0)	1	Number of shielding blocks associated with Beam. Usage: Used by *syngo* RT Therapist Maximum 2 blocks allowed. See Accessories
>Total Block Tray Factor	(300A,00F2)	3	Total block tray transmission for all block trays (between 0 and 1) at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the Control Point Sequence (300A,0111). Usage: Not used. See Accessories
>Block Sequence	(300A,00F4)	1C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks (300A,00F0) is non-zero. One or more items may be included in this sequence. Usage: Used by *syngo* RT Therapist
>>Block Tray ID	(300A,00F5)	3	User-supplied identifier for block tray Usage: Used as primary ID of Block.
>>Source to Block Tray Distance	(300A,00F6)	2C	Radiation Source to attachment edge of block tray assembly (mm). Required if Block Sequence (300A,00F4) is sent. Usage: Fixed for the treatment machine. Not used. See Accessories
>>Block Type	(300A,00F8)	1C	Type of block. Required if Block Sequence (300A,00F4) is sent. See C.8.8.14.4. Enumerated Values: SHIELDING = blocking material is inside contour APERTURE = blocking material is outside contour Usage: Ignored on read. SHIELDING on write.

Attribute Name	Tag	Type	Attribute Description
>>Block Divergence	(300A,00FA)	2C	Indicates presence or otherwise of geometrical divergence. Required if Block Sequence (300A,00F4) is sent. Enumerated Values: PRESENT = block edges are shaped for beam divergence ABSENT = block edges are not shaped for beam divergence Usage: Not used. Value available From Block Tray ID. See Accessories
>>Block Number	(300A,00FC)	1C	Identification number of the Block. The value of Block Number (300A,00FC) shall be unique within the Beam in which it is created. Required if Block Sequence (300A,00F4) is sent. Usage: Used and written by *syngo* RT Therapist
>>Block Name	(300A,00FE)	3	User-defined name for block. Usage: Not Used. See Accessories
>>Material ID	(300A,00E1)	2C	User-supplied identifier for material used to manufacture Block. Required if Block Sequence (300A,00F4) is sent. Usage: Not used. Value available From Block Name. See Accessories
>>Block Thickness	(300A,0100)	2C	Physical thickness of block (in mm) parallel to radiation beam axis. Required if Block Sequence (300A,00F4) is sent and Material ID (300A,00E1) is non-zero length. See C.8.8.14.4. Usage: Not used. Value available From Block Name. See Accessories
>>Block Transmission	(300A,0102)	2C	Transmission through the block (between 0 and 1) at the beam energy specified by the Nominal Beam Energy (300A,0114) of the first Control Point of the Control Point Sequence (300A,0111). Required if Block Sequence (300A,00F4) is sent and Material ID (300A,00E1) is zero length. Usage: Not used. Value available From Block Name. See Accessories
>>Block Number of Points	(300A,0104)	2C	Number of (x,y) pairs defining the block edge. Required if Block Sequence (300A,00F4) is sent. Usage: Not used. Value available From Block Name. See Accessories
>>Block Data	(300A,0106)	2C	A data stream of (x,y) pairs which comprise the block edge. The number of pairs shall be equal to Block Number of Points (300A,0104), and the vertices shall be interpreted as a closed polygon. Coordinates are projected onto the machine isocentric plane in the IEC BEAM LIMITING DEVICE coordinate system (mm). Required if Block Sequence (300A,00F4) is sent. Usage: Not used. Value available From Block Name. See Accessories

Attribute Name	Tag	Type	Attribute Description
>Applicator Sequence	(300A,0107)	3	Introduces sequence of Applicators associated with Beam. Only a single item shall be permitted in this sequence. Usage: Used and written by *syngo* RT Therapist. See Accessories
>>Applicator ID	(300A,0108)	1C	User or machine supplied identifier for Applicator. Required if Applicator Sequence (300A,0107) is sent. Usage: Used and modified by *syngo* RT Therapist If the applicator ID corresponds to a 'STEREOTACTIC' accessory, the beam is classified as a 'stereo-tactic beam' in addition to the *syngo* RT Therapist beam types (See A.7.19.1). See Accessories
>> Accessory Code	(300A,00F9)	3	An identifier for the accessory intended to be read by a device such as a bar-code reader. Usage: Not used
>>Applicator Type	(300A,0109)	1C	Type of Applicator. Required if Applicator Sequence (300A,0107) is sent. Defined Terms: ELECTRON_SQUARE = square electron applicator ELECTRON_RECT = rectangular electron applicator ELECTRON_CIRC = circular electron applicator ELECTRON_SHORT = short electron applicator ELECTRON_OPEN = open (dummy) electron applicator INTRAOPERATIVE = intra-operative (custom) applicator STEREOTACTIC = Stereo-tactic applicator Usage: Fixed for a given Applicator ID. Not used. See Accessories
>>Applicator Description	(300A,010A)	3	User-defined description for Applicator. Usage: Fixed for a given Applicator ID. Not used. See Accessories
>Final Cumulative Meterset Weight	(300A,010E)	1C	Value of Cumulative Meterset Weight (300A,0134) for final Control Point in Control Point Sequence (300A,0111). Required if Cumulative Meterset Weight is non-null in Control Points specified within Control Point Sequence (300A,0111). Usage: Used and modified by *syngo* RT Therapist
>Number of Control Points	(300A,0110)	1	Number of control points in Beam. Usage: Used by *syngo* RT Therapist. Must be an even number. (See Accessories)
>Control Point Sequence	(300A,0111)	1C	Introduces sequence of machine configurations describing treatment beam. Two or more items may be

Attribute Name	Tag	Type	Attribute Description
			included in this sequence. Usage: Used and modified by *syngo* RT Therapist
>>Control Point Index	(300A,0112)	1C	Index of current Control Point, starting at 0 for first Control Point. Required if Control Point Sequence (300A, 0111) is sent. Usage: Used and written by *syngo* RT Therapist
>>Cumulative Meterset Weight	(300A,0134)	2C	Cumulative weight to current control point. Cumulative Meterset Weight for the first item in Control Point Sequence shall always be zero. Cumulative Meterset Weight for the final item in Control Point Sequence shall always be equal to Final Cumulative Meterset Weight. Required if Control Point Sequence (300A,0111) is sent. Usage: Used and written by *syngo* RT Therapist
>>Referenced Dose Reference Sequence	(300C,0050)	3	Introduces a sequence of Dose References for current Beam. One or more items may be included in this sequence. Usage: Used by *syngo* RT Therapist for dose tracking.
>>>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module. Required if Referenced Dose Reference Sequence (300C,0050) is sent. Usage: Used and written by *syngo* RT Therapist
>>>Cumulative Dose Reference Coefficient	(300A,010C)	2C	Coefficient used to calculate cumulative dose contribution from this Beam to the referenced Dose Reference at the current Control Point. Required if Referenced Dose Reference Sequence (300C,0050) is sent. Usage: Used and written by *syngo* RT Therapist.
>>Nominal Beam Energy	(300A,0114)	3	Nominal Beam Energy at control point (MV/MeV). Usage: Visualized in *syngo* RT Therapist.
>>Dose Rate Set	(300A,0115)	3	Dose Rate to be set on treatment machine for segment beginning at current control point (e.g. MU/min). Usage: Read and modified by *syngo* RT Therapist. Can be different between treatment and verification image segments.
>>Wedge Position Sequence	(300A,0116)	3	Introduces sequence of Wedge positions for current control point. One or more items may be included in this

Attribute Name	Tag	Type	Attribute Description
			sequence. Usage: Used and modified by *syngo* RT Therapist
>>>Referenced Wedge Number	(300C,00C0)	1C	Uniquely references Wedge described by Wedge Number (300A,00D2) in Wedge Sequence (300A,00D1). Required if Wedge Position Sequence (300A,0116) is sent. Usage: Used by *syngo* RT Therapist.
>>>Wedge Position	(300A,0118)	1C	Position of Wedge at current Control Point. Required if Wedge Position Sequence (300A,0116) is sent. Enumerated Values: IN, OUT Usage: Always IN or always OUT in a beam. See Accessories
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required for first item of Control Point Sequence, or if Beam Limiting Device changes during Beam. One or more items may be included in this sequence. Usage: Used and modified by *syngo* RT Therapist
>>>RT Beam Limiting Device Type	(300A,00B8)	1C	Type of beam limiting device (collimator). The value of this attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an item of Beam Limiting Device Sequence (300A,00B6). Required if Beam Limiting Device Position Sequence (300A,0116) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction Usage: Visualized and modified in *syngo* RT Therapist
>>>Leaf/Jaw Positions	(300A,011C)	1C	Positions of beam limiting device (collimator) leaf (element) or jaw pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g. X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) in Beam Limiting Device Sequence (300A,00B6).

Attribute Name	Tag	Type	Attribute Description
			Values shall be listed in IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N. Required if Beam Limiting Device Position Sequence (300A,0116) is sent. Usage: Displayed and modified in *syngo* RT Therapist (See MLC Position Validation)
>>Gantry Angle	(300A,011E)	1C	Gantry angle of radiation source, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first item of Control Point Sequence, or if Gantry Angle changes during Beam. Usage: Displayed and modified by *syngo* RT Therapist.
>>Gantry Rotation Direction	(300A,011F)	1C	Direction of Gantry Rotation when viewing gantry from isocenter, for segment following Control Point. Required for first item of Control Point Sequence, or if Gantry Rotation Direction changes during Beam. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation Usage: Displayed and modified in *syngo* RT Therapist. Always NONE except for ARC and CBCT beams
>>Beam Limiting Device Angle	(300A,0120)	1C	Beam Limiting Device angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for first item of Control Point Sequence, or if Beam Limiting Device Angle changes during Beam. Usage: Displayed and modified in *syngo* RT Therapist.
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	Direction of Beam Limiting Device Rotation when viewing beam-limiting device (collimator) from radiation source, for segment following Control Point. Required for first item of Control Point Sequence, or if Beam Limiting Device Rotation Direction changes during Beam. See C.8.8.14.8. Enumerated Values: CW = clockwise, CC = counter-clockwise NONE = no rotation Usage: Always NONE
>>Patient Support Angle	(300A,0122)	1C	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT (turntable) coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for first

Attribute Name	Tag	Type	Attribute Description
			item of Control Point Sequence, or if Patient Support Angle changes during Beam. Usage: Displayed and modified in *syngo* RT Therapist.
>>Patient Support Rotation Direction	(300A,0123)	1C	Direction of Patient Support Rotation when viewing table from above, for segment following Control Point. Required for first item of Control Point Sequence, or if Patient Support Rotation Direction changes during Beam. Enumerated Values: CW = clockwise, CC = counter-clockwise NONE = no rotation Usage: Always NONE.
>>Table Top Eccentric Axis Distance	(300A,0124)	3	Distance (positive) from the IEC PATIENT SUPPORT vertical axis to the IEC TABLE TOP ECCENTRIC vertical axis (mm). Usage: Not used.
>>Table Top Eccentric Angle	(300A,0125)	1C	Table Top (non-isocentric) angle, i.e. orientation of IEC TABLE TOP ECCENTRIC coordinate system with respect to IEC PATIENT SUPPORT coordinate system (degrees). Required for first item of Control Point Sequence, or if Table Top Eccentric Angle changes during Beam. Usage: Displayed and modified in *syngo* RT Therapist.
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	Direction of Table Top Eccentric Rotation when viewing table from above, for segment following Control Point. Required for first item of Control Point Sequence, or if Table Top Eccentric Rotation Direction changes during Beam. Enumerated Values: CW = clockwise, CC = counter-clockwise, NONE = no rotation Usage: Always NONE
>>Table Top Vertical Position	(300A,0128)	2C	Table Top Vertical position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Vertical Position changes during Beam. See DICOM part 3 -C.8.8.14.6. Usage: Displayed and modified by *syngo* RT Therapist
>>Table Top Longitudinal Position	(300A,0129)	2C	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Longitudinal Position changes during Beam. See DICOM part 3 -C.8.8.14.6.

Attribute Name	Tag	Type	Attribute Description
			Usage: Displayed and modified by *syngo* RT Therapist
>>Table Top Lateral Position	(300A,012A)	2C	Table Top Lateral position in IEC TABLE TOP coordinate system (mm). Required for first item of Control Point Sequence, or if Table Top Lateral Position changes during Beam. See DICOM part 3 -C.8.8.14.6. Usage: Displayed and modified by *syngo* RT Therapist
>>Isocenter Position	(300A,012C)	2C	Isocenter coordinates (x, y, z) in the patient based coordinate system described in C.7.6.2.1.1 (mm). Required for first item of Segment Control Point Sequence, or if Segment Isocenter Position changes during Beam. Usage: Used by *syngo* RT Therapist
>>Surface Entry Point	(300A,012E)	3	Patient surface entry point coordinates (x, y, z) in the patient based coordinate system (mm). Usage: Not used
>>Source to Surface Distance	(300A,0130)	3	Source to Patient Surface distance (mm). Usage: Used and modified by *syngo* RT Therapist
Beam_Setup_Instructions	(See Appendix A)	3	Setup notes for this beam, if available.
Treatment_Pause	(See Appendix A)	3	When set, there is an automatic treatment pause inserted before treatment of this beam: 1 – Pause before the first verification image segment, 2 – Pause before the first treatment segment 3 – Pause before both, the first verification image segment and treatment segment.
Treatment_Pause_Comment	(See Appendix A)	3	User-defined comment that describes the reason and action to be performed for that pause.
Gated_Delivery	(See Appendix A)	3	If set, then this beam requires gated delivery.
Bolus_Description	(See Appendix A)	3	The description of the bolus for this beam. (Absent in DICOM.)
Beam_Delta	(See Appendix A)	3	Distance (in mm.) indicating a 'delta' by which the port should be opened from that of the bounding rectangle of the treatment port during capture of the open port image. (See Beam Delta) Currently, the maximum beam delta calculated shall be stored.
Gantry_Table_Movement_Order	(See Appendix A)	3	0 – No defined order 1 – Move Gantry first then table 2 – Move Table first then gantry

Attribute Name	Tag	Type	Attribute Description
Port_Only_Set	(See Appendix A)	3	This treatment beam is planned for only port delivery.
Gantry_Direction_To_Next_Beam	(See Appendix A)	3	Not used

A.7.19.1 Beam Type

Beams in *syngo* RT Therapist can be of several types depending on the type of treatment in the beam.

Following is the list of possible beam types and how their type is determined from the beam.

A beam that cannot be categorized under any of the *syngo* RT Therapist beam types is considered to be an invalid beam.

A.7.19.1.1 Representation of Fixed Beams

syngo RT Therapist will interpret a beam as a fixed beam if:

Beam Type (DICOM) = STATIC

Number of segments excluding verification image segments (see Planned Verification Image Sequence) is equal to 1.

A.7.19.1.2 Representation of ARC Beams

syngo RT Therapist will interpret a beam as an ARC beam if the beam:

1. Has Beam Type (DICOM) = DYNAMIC
2. Gantry Rotation Direction (DICOM) = CW or CC
3. Consists of one treatment segment (i.e. excluding verification image segments (see Planned Verification Image Sequence)) with gantry angle set. Note that the gantry angle could be the same in both the control points.

Examples:

a) An ARC beam without any portal imaging planned:

Consider an ARC beam, without verification image segments, that delivers ‘m’ MU of treatment with some initial and end gantry angles - $\theta 1$ and $\theta 2$ with rotation in the clockwise direction.

It will consist of exactly 2 control points (i.e. 1 segment.):

Control Point 0:

All applicable treatment parameters defined, Cumulative Meterset Weight = 0, Gantry Rotation Direction = CW, Gantry Angle = $\theta 1$

Control Point 1:

Cumulative Meterset Weight = *m*, Gantry Rotation Direction = NONE, Gantry Angle = $\theta 2$

b) ARC beam with portal imaging planned:

Consider an ARC beam where the pair of control points (i and i + 1) represent one treatment segment. The start cumulative meterset weight of the segment is ‘m’ and it delivers radiation of ‘n’ meterset weights.

Control Point i:

All applicable treatment parameters defined, Cumulative Meterset Weight = m, Gantry Rotation Direction = [rotation direction], Gantry Angle = [initial angle]

Control Point i + 1:

Cumulative Meterset Weight = m + n, Gantry Rotation Direction = NONE, Gantry Angle = [final angle]

A.7.19.1.3 Representation of Position Verification Beams

1. Treatment Delivery Type (DICOM) = SETUP.
2. Beam Type (DICOM) = STATIC
3. 1 or 2 valid planned verification image segments. (Single/ Double exposure.)

Position Verification beams group

All positioning beams in a plan are placed under 'Position Verification beams' fraction groups.

Example: Consider a position verification beam that captures a double exposure image:

Control Point Sequence	Cumulative Meterset Wt	MLC position	Segment	Verification Image Capture (See Planned Verification Image Sequence)
CP0	0	Closed Treatment Port*	(Verification Image Segment) Segment 1	Verification Image 1 capture duration
CP1	2	Same as CP0		
CP2	2	Open Port position	(Verification Image Segment) Segment 2	Verification Image 2 capture duration
CP3	4	Same as CP2		

*Closed Treatment Port: The user specifies the closed port shape. This shape is usually derived from an existing beam.

Table 1: Double Exposure position verification beam

A.7.19.1.4 Representation of IMRT Beams

syngo RT Therapist interprets a beam as an IMRT beam if the beam:

1. Has Beam Type attribute (DICOM) = STATIC
2. Is not a position verification beam.
3. Has more than one treatment segment (excluding 'verification image segments').

A.7.19.1.5 Representation of Cone Beam CT Beams

syngo RT Therapist interprets a beam as a CBCT beam if the beam has:

1. Beam Type = DYNAMIC.
2. Only one Segment (Two control points.)
3. Gantry angle is set for both the control points of the segment.
4. Gantry Rotation Direction is set to CW or CC
5. Treatment Delivery Type = SETUP
6. Has one planned verification image corresponding to the entire span of the arc.

A.7.19.1.6 Representation of Setup Beams

syngo RT Therapist represents a setup beam in the DICOM as a single RT Beam module instance with the following properties:

1. Beam Type (300A,00C4) = STATIC
2. Only one segment (two control points.)
3. Treatment Delivery Type (300A,00CE) = SETUP
4. Planned Verification Image Sequence (300A,00CA) is empty or not set.

A.7.19.2 Portal Imaging and Verification Images

A.7.19.2.1 Portal Image Capture Types

a) Single exposure image capture

A single exposure is a verification image that is captured with the treatment port.

In case of pre-port or post-port beams, for single exposure, 2 control points (one verification image segment) are added to the beam with the treatment port shape.

b) Double exposure image capture

In double exposure, the verification image exposure consists of two segments. In the first segment, an image is captured with the treatment port and in the second, the next image is captured with an open port.

In case of pre-port or post-port beams, for a double exposure, two verification image segments (i.e. 4 control points) are added to the beam: The 1st segment (2 control points) with the treatment port shape followed by a 2nd segment with an open port. To determine the open port shape, the beam delta private attribute is used as described in A.7.19.1.3.

A.7.19.2.2 Portal Imaging for Treatment Beams

In *syngo* RT Therapist, for a treatment beam, portal images can only be captured at one or more of several pre-defined times during beam delivery. According to when the portal image is captured during beam delivery, *syngo* RT Therapist defines the following types:

a) Pre-port portal imaging

If pre-port portal imaging is enabled for a beam, then additional *verification image segment(s)* are added *before* the first segment of the treatment beam, i.e. one segment in case of single exposure and two in case of double exposure.

This option is mutually exclusive with post-port imaging.

b) Post-port portal imaging

If post-port portal imaging is enabled for a beam, then additional *verification images segment(s)* are added *after* the last segment of the treatment beam. i.e. one segment in case of single exposure and two in case of double exposure.

This option is mutually exclusive with pre-port imaging.

c) Port-during portal imaging

In port-during, exactly one verification image is captured. The exposure of this image begins at the start of the delivery of the first treatment segment and ends at the end of the delivery of the last treatment segment. Verification image segments are ignored. Port-during cannot be enabled in conjunction with either pre or post-post portal imaging. The Port-during double exposure adds the open port segment after the last segment of the beam.

d) Port-only portal imaging

In the case of PORT-ONLY beam delivery only the verification image segments are delivered and recorded. This is represented by *syngo* RT Therapist in DICOM using a private attribute at the RT Beam level. The verification image segments for PORT_ONLY delivery are stored in the beam in same manner as pre-port verification image segments.

A.7.19.2.3 Planned Verification Image Sequence

Each entry in the planned verification image sequence in the RT Beams module specifies the start and end cumulative meterset weights during the delivery of the beam when a verification image should to be captured. These values should correspond exactly to a pre-port or post-port segment (*verification image segment*) or define a valid port-during capture. *syngo* RT Therapist will ignore all planned verification images except for pre-port, post-port and port-during imaging options. I.e. it will not capture verification images that have been planned such that they do not fall into any of the three categories described above.

Note 1: The meterset delivered by addition of a *verification image segment* must be added to the beam meterset of the referenced beam. For example, if a double exposure of 2 MUs each is added to the beam with meterset 40 MU, then the beam meterset must be increased to 44MU to

accommodate the 4 MU of the two verification image segments in the double exposure. (Recall that, if multiple fraction groups reference a single beam, then they shall have the same beam metersets in both fraction groups.)

Note 2: An entry in the planned verification image sequence that does not correspond to either a verification image segment (determined within the control points) or to a PORT_DURING image capture as described above, is ignored by *syngo* RT Therapist.

Examples:

Note: In these examples, Meterset weights are assumed to be equal to MUs. i.e. Final cumulative meterset weight of beam (300A,010E) = Beam Meterset of referenced beam (300A,0086).

Example 1: Verification Images in Fixed Beams

Consider a Fixed beam with:

- MLC shape MLC1
- Planned Beam Meterset including *verification image segments* = 40
- A double exposure planned at the beginning of the beam. I.e. there are 2 verification images in the planned verification image sequence (say verification image 1 and 2 as shown in Table 3)

Beam meterset	Planned Verification Image 1	Planned Verification Image 2
40	Start Cumulative meterset Wt: 0 End Cumulative meterset Wt: 2	Start Cumulative meterset Wt: 2 End Cumulative meterset Wt: 4

Table 2: Fixed Beam with double exposure delivering 40 MU

The above beam represents a beam with a *double exposure, pre-port* image capture. The control points of the beam shall be as follows:

Control Point	Meterset Weight	MLC Position	Segment Number	Verification Images (from Planned Verification Image Sequence.)
CP0	0	Shape of closed Treatment Port (MLC1)	Segment 1	Verification Image 1 capture duration
CP1	2	Shape of closed Treatment Port (MLC1)		
CP2	2	Shape of Open Treatment Port	Segment 2	Verification Image 2 capture duration
CP3	4	Shape of Open Treatment Port		
CP4	4	Shape of closed Treatment Port (MLC1)	Segment 3	No verification image associated with this segment.
CP5	40	Shape of closed Treatment Port (MLC2)		

Table 3: Control Points of beam in table above

Here, the open port shape is determined using some *beam delta* (See Beam Delta).

If this beam had a single exposure image capture associated with it (i.e. only the first verification image is present), then the Beam Meterset would be reduced by the MUs delivered during the open port verification image segment (i.e. 2MU) to 38MU.

The control points would be as follows:

Control Point	Meterset Weight	MLC Position	Segment Number	Verification Images (from Planned Verification Image Sequence.)
CP0	0	Shape of closed Treatment Port (MLC1)	Segment 1	Verification Image 1 capture duration
CP1	2	Shape of closed Treatment Port (MLC1)		
CP3	2	Shape of closed Treatment Port (MLC1)	Segment 3	No verification image associated with this segment
CP4	38	Shape of closed Treatment Port (MLC2)		

Table 4: Control points of beam in Table 2 with Single exposure

Now, the total delivered MU is 38 as the open port segment is no longer present.

Example 2: Addition of verification image segments to a fixed beam

Consider a beam which initially had one treatment segment without verification images:

Control Point Sequence	Cumulative Meterset Wt	MLC position
CP0	0	MLC1 (Some Treatment Port)
CP1	20	MLC1

Table 5: Fixed Beam without verification images

Pre-port, single exposure:

If a 2MU exposure, PRE_PORT verification image is attached to this beam now, the beam meterset is increased by 2MU to 22MU and 2 control points are inserted as follows:

Control Point Sequence	Cumulative Meterset Wt	MLC position	Image Capture
CP0	0	*Maximum field boundary of beam.*	Verification Image Capture
CP1	2	Same as CP0 = MLC1	
CP2	2	MLC1	Treatment Segment
CP3	22	MLC1	

Table 6: FixedBeam with pre-port single exposure images attached

Pre-port, double exposure:

If, instead, 2 images (forming a double exposure) are added to the original beam, with each exposure being of 2 MU each, then the original beam's Meterset is changed to 24MU and 4 additional control points are added as follows:

Control Point Sequence	Cumulative Meterset Wt	MLC position	Image Capture
CP0	0	*Maximum field boundary of beam.*	Verification Image1 Captured
CP1	2	Same as CP0 = MLC1	
CP2	2	Open Port	Verification Image 2 Captured
CP3	4	Open Port	
CP4	4	MLC1	Treatment Segment
CP5	24	MLC1	

Table 7: Fixed Beam with pre-port double exposure images attached

PORT_DURING:

If the portal imaging planned for the beam was a PORT_DURING type image capture, then the beam (in table 8) would have a verification image in the planned verification image sequence whose start and end cumulative meterset weights would correspond to the start meterset weight of the 1st treatment segment and the end meterset weight of the last treatment segment as follows:

Control Point Sequence	Cumulative Meterset Wt	MLC position	Image Capture (from planned verification image sequence.)
CP0	0	MLC1	Treatment Segment (with Verification Image Capture)
CP1	20	MLC1	

Table 8: Fixed Beam with PORT_DURING image attached

Note that, for PORT_DURING imaging, as no verification image segments are added to the beam, the total meterset delivered is the same as the planned meterset. (in this case, 20).

Example 3: Representation of verification image segments in IMRT beams:

The following table represents a PRE_PORT, *double exposure* IMRT beam with beam Meterset 84 MU. Each exposure is assumed to be of 2 MU each.

Control Point Sequence	Cumulative Meterset Wt	MLC position	Segment	Image Capture
CP0	0	*Maximum field boundary of beam.*	(Verification Image segment) Segment 1	1st verification image of double exposure captured
CP1	2	Same as CP0		
CP2	2	Open Port shape	(Verification Image segment) Segment 2	2nd Verification image of double exposure captured
CP3	4	Open Port shape		
CP4	4	MLC1	Segment 3	IMRT treatment
CP5	34	MLC1		
CP6	34	MLC2	Segment 4	IMRT treatment
CP7	70	MLC2		
CP8	70	MLC3	Segment 5	IMRT treatment
CP9	84	MLC3		

Table 9: Pre-Port IMRT Beam with double exposure

If the beam above were configured with a '*post-port*' option, the control point sequence would be as follows:

Control Point Sequence	Cumulative Meterset Wt	MLC position	Segment	Image Capture
CP0	0	MLC1	Segment 3	IMRT treatment
CP1	30	MLC1		
CP2	30	MLC2	Segment 4	IMRT treatment
CP3	66	MLC2		
CP4	66	MLC3	Segment 5	IMRT treatment
CP5	80	MLC3		
CP6	80	*Maximum field boundary of beam.*	(Verification Image segment.) Segment 6	1st verification image of double exposure captured
CP7	82	Same as CP6		
CP8	82	Open Port shape	(Verification Image segment.) Segment 7	2nd Verification image of double exposure captured
CP9	84	Open Port shape		

Table 10: Post-Port IMRT Beam with double exposure

At treatment delivery time, it is possible to disable verification image capture for the beam. Here, the verification image segments will not be delivered i.e. control points CP0 through to CP3 will not be delivered i.e. only the 80 MU to be delivered for the treatment will be delivered.

If a 2MU exposure, PRE_PORT verification image is attached to this beam now, the beam meterset is increased by 2MU to 22MU and 2 control points are inserted as follows:

During treatment record browsing, it is important to identify beams where only the verification images were disabled and distinguish them from incomplete beams where treatment failed within some control points. (See Recording Verification Image Segments)

Example 4: Example of invalid planned verification imaging within a beam.

Recalling Note 2 in Section Planned Verification Image Sequence, a planned verification image that does not correspond to a single verification image segment (the open or closed port segment of either a pre- or post- port image capture.) or to a PORT_DURING verification image capture is considered invalid.

Consider a beam with only one segment (i.e. 2 control points) and a final cumulative meterset weight of 20.

- Control Point 0:
- Cumulative Meterset weight: 0

- Control Point 1:
- Cumulative Meterset weight: 20

If there is a planned verification image within the planned verification image sequence of the beam that has the following attributes:

- Start Cumulative meterset Wt – 5
- End Cumulative meterset Wt – 10

This image does not correspond to a verification image segment in the beam and it also does not correspond to the delivery of all the treatment segments (PORT_DURING). Hence this image shall be considered invalid by *syngo* RT Therapist and cannot be captured.

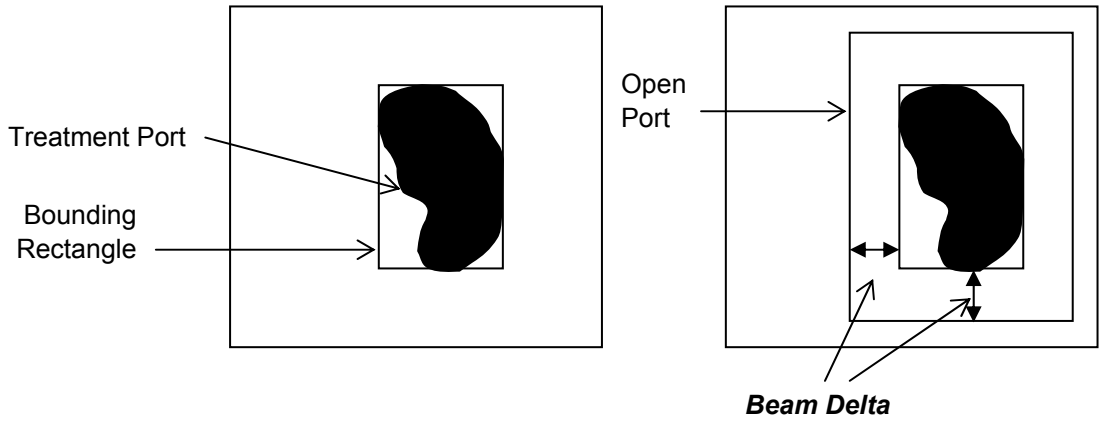
Note that the beam is itself is not invalidated by this invalid planned verification image. Only this image will not be considered for capture by *syngo* RT Therapist.

A.7.19.3 Beam Delta

The open port shape for verification image capture is determined by

a) The bounding rectangle of the treatment port shape.

b) A ‘delta’ by which the port (the bounding rectangle) is further opened so that further structures are visible in the image.



This delta is the ‘Beam Delta’ of the beam.

Figure 12: Usage of Beam Delta to determine open port shape

A.7.19.4 Sequencing of Beams

The order of beams in the referenced beam sequence in the fraction group represents the order in which the beams will be visualized under that fraction group.

A.7.19.5 Other Consistency Requirements for Beams in *syngo* RT Therapist

1. If there is no Patient setup module within the RT Plan, *syngo* RT Therapist shall, at load, create a default patient setup module and update all RT Beams in the plan to reference this patient setup.
2. A beam must always unambiguously identify (zero or) one patient setup. i.e. It is invalid for a beam to refer to a particular patient setup and be referred to by a fraction group that references a different patient setup.
3. All Treatment beams should be part of one or more fraction groups. A beam can only be delivered as part of a fraction group.
4. A Beam not associated with a setup is an invalid beam.

A.7.19.6 Control Points in *syngo* RT Therapist

A.7.19.6.1 0 MU segments

0 MU Segments are disallowed in *syngo* RT Therapist. A set of control points that define a segment must deliver some radiation. Otherwise, the entire beam is considered to be invalid and is rejected. Setup beams are the only exception to this rule. When a new beam is edited in *syngo* RT Therapist, a configurable, non-zero, minimum MU value is required for each segment of the beam.

A.7.19.6.2 Other Consistency Requirements for Control Points

1. Number of Control Points must be even:

All beams consist of an integral number of valid segments. A segment is identified as a pair of control points that delivers some radiation. Hence, it is invalid to have an odd number of control points as, in that case, at least one of the control points will not part of any segment.

2. All control points within the beam must have the same gantry angle, if defined, except for ARC and Cone Beam CT beams.
3. In DICOM STATIC beams, all Control Point Sequence attributes must remain unchanged between consecutive pairs of control points with changing Cumulative Meterset Weight.
4. All table values must be defined in all segments (with the same values.), only in the 1st control point or not defined at all in any control point. Otherwise the beam is considered inconsistent and cannot be treated.
5. Absolute and Relative Setup

When a plan is imported from a treatment planning system, the table displacements (relative table offsets.) in the patient setup module may or may not be set. Similarly, beams that reference the setup must be either *all* relative beams or *all* absolute beams to be deliverable. (See DICOM part 3 - C.8.8.14.6.). In *syngo* RT Therapist, a setup and associated beams are assumed to use either relative or absolute table positioning based on the following rules:

***syngo* RT Therapist Setup Type Interpretation**	**Criteria**
Absolute setup	At least 1 beam referencing this setup has some table values defined.
Relative Setup	No beam referencing this setup has any table values defined.

Table 11: Absolute and Relative Setup

Invalid table positioning scenarios:

It is invalid to have the patient setup module's table displacement values set when the beams referring to it use absolute positioning. When this happens, the beams in the plan are undeliverable till the table values in the plans are edited to make the setup type consistent with either an absolute or relative setup as defined above.

A.7.19.6.3 MLC Position Validation:

The position of the leaves of the MLC at each control point must be valid otherwise the beam will not be deliverable.

Leaf position validation:

1. A given leaf must be positioned within its prescribed range of motion and two opposing leaves may not overlap.
2. No single leaf may extend past either of the two neighboring leaves of its opposing leaf.

Coverage validation:

1. The position of each Y jaw must cover all leaves up to its *MLC coverage position* applying a 2 mm tolerance window.
2. In IEC terms, the *MLC coverage position* for a given Y jaw is determined to be the *innermost* edge of the *innermost closed* leaf-pair minus 5 mm for the Y1 jaw and plus 5 mm for the Y2 jaw.
3. *Innermost* means in the direction of the Y jaw's full extension into the over-travel region.
4. A leaf-pair is *closed* if the distance between the two leaves is less than or equal to 2mm; otherwise, it is *open*.
5. The *innermost closed* leaf pair is the last leaf-pair, starting from the full open position for the Y jaw in question (X1.1 / X2.1 for Y1 and X1.29 / X2.29 for Y2) that is *closed* without any intervening *open* leaf-pairs.
6. As an exception, if all leaf pairs are *closed*, the *MLC coverage position* for both Y jaws is considered to be 0.0.
7. Note that, in cases where the leaves are closed well into the over-travel region, the *MLC coverage position* may extend past the physical range of travel of the corresponding Y jaw. In this case, the MLC setup is undeliverable and has to be made deliverable via edits at the workspace.

A.7.19.7 Accessories

Accessory codes and accessory parameters

Accessory codes (IDs) for wedges, applicators and blocks are supported. The accessory parameters are specified by the IDs themselves. For wedges and applicators, all parameters except the ID and type are ignored. Blocks are identified using the Block tray ID (300A,00F6) attribute. For a complete list of Accessory codes and their interpretation.

Wedge position

syngo RT Therapist does not support MOTORIZED wedges. (Even virtual wedges are represented as a DICOM static wedge.) Hence, within a beam a wedge must be either IN or OUT for all the segments in the beam. If the wedge in the wedge sequence is either present in only some segments or is present in all segments but is IN in some segments and OUT in others, then the beam is considered to be invalid.

A.7.20 RT General Treatment Record Module

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	Instance number identifying this particular instance of the object. Usage: Used by *syngo* RT Therapist
Treatment Date	(3008,0250)	2	Date when current fraction was delivered, or Date last fraction was delivered in case of RT Treatment Summary Record IOD. Usage: Written & used by *syngo* RT Therapist.
Treatment Time	(3008,0251)	2	Time when current fraction was delivered (begun), or Time last fraction was delivered (begun) in case of RT Treatment Summary Record IOD. Usage: Written & used by *syngo* RT Therapist for both Beams treatment record and Treatment Summary Record IODs.
Referenced RT Plan Sequence	(300C,0002)	2	A sequence that provides reference to a RT Plan SOP Class/Instance pair. Only a single Item shall be permitted in this Sequence. Usage: Written and used by *syngo* RT Therapist.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C,0002) is sent.
Referenced Treatment Record Sequence	(3008,0030)	3	A sequence that provides reference to RT Treatment Record SOP Class/Instance pairs to which the current RT Treatment Record is significantly related. The sequence may contain one or more items. Usage: In *syngo* RT Therapist: For a treatment summary record IOD, this sequence will contain all the beam session records for the entire treatment upto the session for which the Summary was generated.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Treatment Record Sequence (3008,0030) is sent.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Treatment Record Sequence (3008,0030) is sent.

A.7.21 RT Treatment Summary Record

Attribute Name	Tag	Type	Attribute Description
Current Treatment Status	(3008,0200)	1	Status of the Treatment at the time the Treatment Summary was created. Enumerated Values: NOT_STARTED, ON_TREATMENT, ON_BREAK, SUSPENDED, STOPPED, COMPLETED. Usage: Written and used by *syngo* RT Therapist. Only ON_TREATMENT and COMPLETED state are used.
Treatment Status Comment	(3008,0202)	3	Comment on current treatment status. Usage: Not used.

Attribute Name	Tag	Type	Attribute Description
First Treatment Date	(3008,0054)	2	Date of delivery of the first treatment. Usage: Written and Displayed in *syngo* RT Therapist
Most Recent Treatment Date	(3008,0056)	2	Date of delivery of the most recent administration. Usage: Written and Displayed in *syngo* RT Therapist
Fraction Group Summary Sequence	(3008,0220)	3	Introduces sequence describing current state of planned vs. delivered fraction groups. The sequence may contain one or more items. Usage: Used by *syngo* RT Therapist. Contains all the fraction groups that have been delivered since the beginning of the plan's treatment till now. (See Creation of Treatment Summary Records)
>Referenced Fraction Group Number	(300C,0022)	3	References Fraction Group Number (300A,0071) in Fraction Group Sequence (300A,0070) in the referenced RT Plan. Usage: Written and used by *syngo* RT Therapist
>Fraction Group Type	(3008,0224)	2C	Indicates type of fraction group. Required if Fraction Group Summary Sequence (3008,0220) is sent. Enumerated Values: EXTERNAL_BEAM, BRACHY. Usage: Always EXTERNAL_BEAM
>Number of Fractions Planned	(300A,0078)	2C	Number of fractions planned for this fraction group. Required if Fraction Group Summary Sequence (3008,0220) is sent. Usage: The total number of fractions planned for this group.
>Number of Fractions Delivered	(3008,005A)	2C	Number of fractions delivered as of Treatment Summary Report. Required if Fraction Group Summary Sequence (3008,0220) is sent. Usage: Used by *syngo* RT Therapist. Total number of fractions that have been delivered till now for this fraction group.
>Fraction Status Summary Sequence	(3008,0240)	3	Introduces sequence describing status of fractions in Fraction Group. The sequence may contain one or more items. Usage: Used by *syngo* RT Therapist. Contains entries for each fraction of this fraction group that has been delivered as part of this plan till now. (See Creation of Treatment Summary Records)
>>Referenced Fraction Number	(3008,0223)	1C	Identifies fraction. Required if Fraction Status Summary Sequence (3008,0240) is sent. Usage: Written and used by *syngo* RT Therapist. (See Recording Verification Image Segments)
>>Treatment Date	(3008,0250)	2C	Date when fraction was delivered. Required if Fraction Status Summary Sequence (3008,0240) is sent. Usage: Written and used by *syngo* RT Therapist
>>Treatment Time	(3008,0251)	2C	Time when fraction was delivered. Required if Fraction Status Summary Sequence (3008,0240) is sent. Usage: Written and used by *syngo* RT Therapist
>>Treatment Termination Status	(3008,002A)	2C	Conditions under which treatment was terminated. Required if Fraction Status Summary Sequence (3008,0240) is sent. Enumerated Values: NORMAL = treatment terminated normally OPERATOR = operator terminated treatment MACHINE = machine terminated treatment for other than NORMAL condition UNKNOWN = status at termination unknown Usage: Used for identification of incomplete/aborted treatment sessions. (See Rules for Setting Treatment

Attribute Name	Tag	Type	Attribute Description
			Termination Status for Fractions)
>> Treatment_Notes (Private attribute.)	(See appendix A)		Free text for fraction treatment delivery notes.
Treatment Summary Measured Dose Reference Sequence	(3008,00E0)	3	Introduces sequence of references to Measured Dose References. The sequence may contain one or more items. Usage: Not used
>Referenced Dose Reference Number	(300C,0051)	3	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Plan referenced in Referenced RT Plan Sequence (300C,0002) of RT General Treatment Record Module.
>Dose Reference Description	(300A,0016)	3	User-defined description of Dose Reference.
>Cumulative Dose to Dose Reference	(3008,0052)	1C	Cumulative Dose delivered to Dose Reference (Gy). Required if Treatment Summary Dose Reference Sequence (3008,00E0) is sent.
Treatment Summary Calculated Dose Reference Sequence	(3008,0050)	3	Introduces sequence of references to Calculated Dose References. The sequence may contain one or more items. Usage: Used by *syngo* RT Therapist
>Referenced Dose Reference Number	(300C,0051)	3	Uniquely identifies Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Plan referenced in Referenced RT Plan Sequence (300C,0002) of RT General Treatment Record Module. Usage: Used by *syngo* RT Therapist
>Dose Reference Description	(300A,0016)	3	User-defined description of Dose Reference. Usage: Written and displayed by *syngo* RT Therapist. This value is copied from the Dose reference description attribute of the corresponding dose reference in the RT prescription module of the RT Plan.
>Cumulative Dose to Dose Reference	(3008,0052)	1C	Cumulative Dose delivered to Dose Reference (Gy). Required if Treatment Summary Dose Reference Sequence (3008,0050) is sent. Usage: Written and read by *syngo* RT Therapist

A.7.21.1 Creation of Treatment Summary Records

Treatment Summary records are generated as part of the Treatment Summary Record IOD. A new Treatment Summary record module is created at the end of each treatment session. At the time of creation of a new treatment summary record, the contents of the latest treatment summary record (from either the current plan or the latest predecessor that was treated.) are copied into it and then it is updated for the current session as and when each beam is treated. The new record will finally contain the details of all the fraction groups that have been treated till now, including the current session. In the RT general treatment record module associated with the IOD, the referenced treatment record sequence will contain the beam session records of all the beams that were treated for the plan including those that were delivered in that session.

The Treatment Termination Status (3008,002A) attribute gives the status of the treatment of a particular fraction within a fraction group in the treatment summary record. Its value is set to NORMAL, MACHINE, OPERATOR or UNKNOWN according to the following conditions.

A.7.21.2 Rules for Setting Treatment Termination Status for Fractions

- If the treatment terminated during the delivery of a beam, the treatment termination status for this fraction is set to the “Treatment Termination Status” of the *incomplete* beam in the corresponding Treatment Session Beam record.
- If all selected beams were completely delivered but the number of completed beams in the beams session record is less than the number of beams in the fraction group at the time of treatment, then the treatment termination status is determined from the reason why all beams were not delivered as follows:
    - MACHINE : If, due to a machine interlock (or some other machine-related event) between selected beams, then the Treatment Termination Status is set to MACHINE.
    - OPERATOR: If not all beams were selected for delivery or if the operator turned off the treatment between beams, then the treatment termination status is set to OPERATOR.
    - UNKNOWN: If the reason for termination does not fit either of the above two conditions, then the status is set to UNKNOWN.

A.7.21.2.1 Treatment Termination Status and *Complete* Fraction Groups

If a fraction is not *complete*, (see 1), then it’s “Treatment Termination Status” is set to OPERATOR if the current delivery sequence was delivered successfully. In case of an abnormal termination during the delivery sequence, the reason for the termination is recorded according to the rules above.

A.7.21.2.2 Position Verification Group Delivery

Any delivery of a Position Verification group is marked as NORMAL once at least one segment in any of the beams in the group was delivered.

A.7.22 RT Beam Session Record Module

Attribute Name	Tag	Type	Attribute Description
Operator Name	(0008,1070)	2	Name of operator administering treatment session. Usage: Written and used by *syngo* RT Therapist. Refer to Section Operator Name Encoding in *syngo* RT Therapist.
Referenced Fraction Group Number	(300C,0022)	3	Identifier of Fraction Group within referenced RT Plan. Usage: Written and used by *syngo* RT Therapist
Number of Fractions Planned	(300A,0078)	2	Total number of treatments (Fractions) planned for current Fraction Group. Usage: The total number of fractions planned for this group. Identified from the corresponding fraction group in the RT Plan.
Primary Dosimeter Unit	(300A,00B3)	1	Measurement unit of machine dosimeter. Enumerated Values: MU = Monitor Unit MINUTE = minute Usage: Written by *syngo* RT Therapist. Always MU.
Treatment Session Beam Sequence	(3008,0020)	1	Introduces sequence of Beams administered during treatment session. The sequence may contain one or more items. Usage: Used by *syngo* RT Therapist
>Referenced Beam Number	(300C,0006)	3	References Beam specified by Beam Number (300A,00C0) in Beam Sequence (300A,00B0) in RT Beams Module within referenced RT Plan. Usage: Written and used by *syngo* RT Therapist.
>Beam Name	(300A,00C2)	3	User-defined name for delivered Beam. Usage: Written and used by *syngo* RT Therapist
>Beam Description	(300A,00C3)	3	User-defined description for delivered Beam. Usage: Written and used by *syngo* RT Therapist
>Beam Type	(300A,00C4)	1	Motion characteristic of delivered Beam. Enumerated Values: STATIC = all beam parameters remain unchanged during delivery DYNAMIC = one or more beam parameters changes during delivery Usage: Written and used by *syngo* RT Therapist
>Radiation Type	(300A,00C6)	1	Particle type of delivered Beam. Defined Terms: PHOTON, ELECTRON, NEUTRON, PROTON. Usage: Written and used by *syngo* RT Therapist. Only PHOTON & ELECTRON supported.
>High-Dose Technique Type	(300A,00C7)	1C	Type of high-dose treatment technique. Defined Terms: NORMAL = Standard treatment TBI = Total Body Irradiation HDR = High Dose Rate

Attribute Name	Tag	Type	Attribute Description
			Required if treatment technique requires a dose that would normally require overriding of treatment machine safety controls. Usage: Not used
>Referenced Verification Image Sequence	(300C,0040)	3	Introduces sequence of verification images obtained during delivery of current beam. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist
>>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Verification Image Sequence (300C,0040) is sent. Usage: Written and used by *syngo* RT Therapist
>>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Verification Image Sequence (300C,0040) is sent. Usage: Written and used by *syngo* RT Therapist
>>Start Meterset	(3008,0078)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number at which image acquisition starts. Usage: Written and used by *syngo* RT Therapist
>>End Meterset	(3008,007A)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number at which image acquisition ends. Usage: Written and used by *syngo* RT Therapist
>Referenced Measured Dose Reference Sequence	(3008,0080)	3	Introduces sequence of doses measured during treatment delivery for current Beam. The sequence may contain one or more items. Usage: Not used
>>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely references Dose Reference specified by Dose Reference Number (300A,0012) in Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Plan. Required if Referenced Measured Dose Reference Sequence (3008,0080) is sent and Referenced Measured Dose Reference Number (3008,0082) is not sent. It shall not be present otherwise.
>>Referenced Measured Dose Reference Number	(3008,0082)	1C	Uniquely references Measured Dose Reference specified by Measured Dose Reference Number (3008,0064) in Measured Dose Reference Sequence (3008,0010). Required if Referenced Measured Dose Reference Sequence (3008,0080) is sent and Referenced Dose Reference Number (300C, 0051) is not sent. It shall not be present otherwise.
>>Measured Dose Value	(3008,0016)	1C	Measured Dose in units specified by Dose Units (3004,0002) in sequence referenced by Measured Dose Reference Sequence (3008,0010) or Dose Reference Sequence (300A,0010) in RT Prescription Module of referenced RT Plan as defined above. Required if Referenced Measured Dose Reference Sequence (3008,0080) is sent.

Attribute Name	Tag	Type	Attribute Description
>Referenced Calculated Dose Reference Sequence	(3008,0090)	3	Introduces sequence of doses estimated for each treatment delivery. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist.
>>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely identifies Dose Reference specified by Dose Reference Number (300A, 0012) in Dose Reference Sequence (300A, 0010) in RT Prescription Module of referenced RT Plan. Required if Referenced Calculated Dose Reference Sequence (3008,0090) is sent and Referenced Calculated Dose Reference Number (3008,0092) is not sent. Usage: Written & used by *syngo* RT Therapist.
>>Referenced Calculated Dose Reference Number	(3008,0092)	1C	Uniquely identifies Calculated Dose Reference specified by Calculated Dose Reference Number (3008,0072) within Calculated Dose Reference Sequence (3008,0070). Required if Referenced Calculated Dose Reference Sequence (3008,0090) is sent and Referenced Dose Reference Number (300C,0051) is not sent. Usage: Written and used by *syngo* RT Therapist.
>>Calculated Dose Reference Dose Value	(3008,0076)	1C	Calculated Dose (Gy). Required if Referenced Calculated Dose Reference Sequence (3008,0090) is sent. Usage: Written and used by *syngo* RT Therapist.
>Source-Axis Distance	(300A,00B4)	3	Radiation source to gantry rotation axis distance of the equipment that was used for beam delivery (mm). Usage: Not used.
>Beam Limiting Device Leaf Pairs Sequence	(3008,00A0)	1	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) leaf pair values. The sequence may contain one or more items.
>>RT Beam Limiting Device Type	(300A,00B8)	1	Type of beam limiting device (collimator). Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction Usage: Written and used by *syngo* RT Therapist
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws). Usage: Written and used by *syngo* RT Therapist
>Referenced Patient Setup Number	(300C,006A)	3	Uniquely identifies Patient Setup used within current beam, specified by Patient Setup Number (300A, 0182) within Patient Setup Sequence (300A, 0180) of RT Treatment

Attribute Name	Tag	Type	Attribute Description
			Record. Usage: Written and used by *syngo* RT Therapist. References a RT Patient Setup module in the Beams Treatment record. This Setup module stores the patient setup at the time of treatment of the beam.
>Number of Wedges	(300A,00D0)	1	Number of wedges associated with current delivered Beam. Usage: Written and used by *syngo* RT Therapist
>Recorded Wedge Sequence	(3008,00B0)	1C	Introduces sequence of treatment wedges present during delivered Beam. Required if Number of Wedges (300A,00D0) is non-zero. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist
>>Wedge Number	(300A,00D2)	3	Identification number of the Wedge. The value of Wedge Number (300A,00D2) shall be unique within the wedge sequence. Usage: Written and used by *syngo* RT Therapist
>>Wedge Type	(300A,00D3)	2C	Type of wedge defined for delivered Beam. Required if Recorded Wedge Sequence (3008,00B0) is sent. Defined Terms: STANDARD = standard (static) wedge DYNAMIC = moving Beam Limiting Device (collimator) jaw simulating wedge MOTORIZED = single wedge which can be removed from beam remotely Usage: Not used. See Accessories
>>Wedge ID	(300A,00D4)	3	User-supplied identifier for wedge. Usage: Written and used by *syngo* RT Therapist
>>Wedge Angle	(300A,00D5)	3	Nominal wedge angle delivered (degrees). Usage: Not written by *syngo* RT Therapist (Determined from Wedge ID) See Accessories
>>Wedge Orientation	(300A,00D8)	3	Orientation of wedge, i.e. orientation of IEC WEDGE FILTER coordinate system with respect to IEC BEAM LIMITING DEVICE coordinate system (degrees). Usage: Not written by *syngo* RT Therapist. (Determined from Wedge ID) See Accessories
>Number of Compensators	(300A,00E0)	2	Number of compensators associated with current delivered Beam. Usage: Not used. Always zero when the record is generated by *syngo* RT Therapist. See Accessories
>Recorded Compensator Sequence	(3008,00C0)	3	Introduces sequence of treatment compensators associated with current Beam. The sequence may contain one or more items. Usage: Not used. See Accessories
>>Referenced Compensator Number	(300C,00D0)	1C	Uniquely identifies compensator specified by Compensator Number (300A,00E4) within Beam referenced by Referenced Beam Number (300C,0006). Required if Recorded

Attribute Name	Tag	Type	Attribute Description
			Compensator Sequence (3008,00C0) is sent. Usage: Not used.
>>Compensator Type	(300A,00EE)	2C	Type of compensator (if any). Required if Recorded Compensator Sequence (3008,00C0) is sent. Defined Terms: STANDARD = physical (static) compensator DYNAMIC = moving Beam Limiting Device (collimator) simulating compensator Usage: Not used.
>>Compensator ID	(300A,00E5)	3	User-supplied identifier for compensator. Usage: Not used. See Accessories
>Number of Boli	(300A,00ED)	2	Number of boli used with current Beam. Usage: Not used
>Referenced Bolus Sequence	(300C,00B0)	3	Introduces sequence of boli associated with Beam. The sequence may contain one or more items. Usage: Not used.
>>Referenced ROI Number	(3006,0084)	1C	Uniquely identifies ROI representing the bolus specified by ROI Number (3006,0022) in Structure Set ROI Sequence (3006,0020) in Structure Set Module within RT Structure Set IOD referenced by referenced RT Plan in Referenced RT Plan Sequence (300C,0002) in RT General Treatment Record Module. Required if Referenced Bolus Sequence (300C,00B0) is sent. Usage: Not used
>Number of Blocks	(300A,00F0)	2	Number of shielding blocks or Electron Inserts associated with Beam. Usage: Written and used by *syngo* RT Therapist. See Accessories
>Recorded Block Sequence	(3008,00D0)	3	Introduces sequence of blocks associated with current Beam. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist. See Accessories
>>Block Tray ID	(300A,00F5)	3	User-supplied identifier for block tray or Electron Insert. Usage: Used to store the Block ID.
>>Referenced Block Number	(300C,00E0)	3	Uniquely identifies block specified by Block Number (300A,00FC) within Beam referenced by Referenced Beam Number (300C,0006). Usage: Written and used by *syngo* RT Therapist.
>>Block Name	(300A,00FE)	2C	User-defined name for block. Required if Recorded Block Sequence (3008,00D0) is sent. Usage: Not used.
>Applicator Sequence	(300A,0107)	3	Introduces sequence of Applicators associated with Beam. Only a single item shall be permitted in this sequence. Usage: Written and used by *syngo* RT Therapist. See Accessories
>>Applicator ID	(300A,0108)	1C	User or machine supplied identifier for Applicator. Required if Applicator Sequence (300A,0107) is sent.

Attribute Name	Tag	Type	Attribute Description
			Usage: Written and used by *syngo* RT Therapist
>>Applicator Type	(300A,0109)	1C	Type of Applicator. Required if Applicator Sequence (300A,0107) is sent. Defined Terms: ELECTRON_SQUARE = square electron applicator ELECTRON_RECT = rectangular electron applicator ELECTRON_CIRC = circular electron applicator ELECTRON_SHORT = short electron applicator ELECTRON_OPEN = open (dummy) electron applicator INTRAOPERATIVE = intraoperative (custom) applicator STEREOTACTIC = stereotactic applicator Usage: Written and used by *syngo* RT Therapist. See Accessories
>>Applicator Description	(300A,010A)	3	User-defined description for Applicator. Usage: Not used. See Accessories
>Current Fraction Number	(3008,0022)	2	Fraction number for this beam administration. Usage: Used to identify the fraction number as part of which, this beam was delivered.
>Treatment Delivery Type	(300A,00CE)	2	Delivery Type of treatment. Defined Terms: TREATMENT = normal patient treatment Set for the treatment segments of the beam. OPEN_PORTFILM = portal image acquisition with open field Set for open port segments of double exposure beams. TRMT_PORTFILM = portal image acquisition with treatment port Set for treatment port segments of the beams. CONTINUATION = continuation of interrupted treatment Set for beams resumed using late resumption. Usage: Written and used by *syngo* RT Therapist
>Treatment Termination Status	(3008,002A)	1	Conditions under which treatment was terminated. Enumerated Values: NORMAL = treatment terminated normally OPERATOR = operator terminated treatment MACHINE = machine terminated treatment UNKNOWN = status at termination unknown Usage: Written and used by *syngo* RT Therapist
>Treatment Termination Code	(3008,002B)	3	Treatment machine termination code. This code is dependent upon the particular application and equipment. Usage: Not used

Attribute Name	Tag	Type	Attribute Description
>Treatment Verification Status	(3008,002C)	2	Conditions under which treatment was verified by a verification system. Enumerated Values: VERIFIED = treatment verified Normal treatments without overrides. VERIFIED_OVR = treatment verified with at least one out-of-range value overridden Normal treatments with overrides. NOT_VERIFIED = treatment verified manually Displayed and written when a treatment is recorded manually. Usage: Used and written by *syngo* RT Therapist.
>Specified Primary Meterset	(3008,0032)	3	Desired machine setting of primary meterset. Usage: Written and used by *syngo* RT Therapist
>Specified Secondary Meterset	(3008,0033)	3	Desired machine setting of secondary meterset. Usage: Not used
>Delivered Primary Meterset	(3008,0036)	3	Machine setting actually delivered as recorded by primary meterset. Usage: Written and used by *syngo* RT Therapist
>Delivered Secondary Meterset	(3008,0037)	3	Machine setting actually delivered as recorded by secondary meterset. Usage: Not used
>Specified Treatment Time	(3008,003A)	3	Treatment Time set (sec). Usage: Not used
>Delivered Treatment Time	(3008,003B)	3	Treatment Time actually delivered (sec). Usage: Not used
>Number of Control Points	(300A,0110)	1	Number of control points delivered. Usage: Written and used by *syngo* RT Therapist
>Control Point Delivery Sequence	(3008,0040)	1	Introduces sequence of beam control points for current treatment beam. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist
>>Referenced Control Point Index	(300C,00F0)	3	Uniquely identifies Control Point specified by Control Point Index (300A,0112) within Beam referenced by Referenced Beam Number (300C,0006). Usage: Written and used by *syngo* RT Therapist
>>Treatment Control Point Date	(3008,0024)	1	Date administration of treatment beam began. Usage: Written and used by *syngo* RT Therapist
>>Treatment Control Point Time	(3008,0025)	1	Time administration of treatment beam began. Usage: Written and used by *syngo* RT Therapist
>>Specified Meterset	(3008,0042)	2	Desired machine setting for current control point. Usage: Used to identify incomplete Control Points. (See 0)
>>Delivered Meterset	(3008,0044)	1	Machine setting actually delivered at current control point. Usage: Used to identify incomplete Control Points.
>>Dose Rate Set	(300A,0115)	2	Dose Rate set on treatment machine for segment beginning at current control point

Attribute Name	Tag	Type	Attribute Description
			(meterset/min). Usage: Written and used by *syngo* RT Therapist
>>Dose Rate Delivered	(3008,0048)	2	Dose Rate actually delivered for segment beginning at current control point (meterset/min). Usage: Written and used by *syngo* RT Therapist
>>Nominal Beam Energy	(300A,0114)	3	Nominal Beam Energy at control point. Usage: Written and used by *syngo* RT Therapist
>>Nominal Beam Energy Unit	(300A,0015)	1C	Units used for Nominal Beam Energy (300A,0114). Required if Nominal Beam Energy (300A,0114) is sent. Defined Terms: MV = Megavolt MEV = Mega electron-Volt If Radiation Type (300A,00C6) is PHOTON, Nominal Beam Energy Unit (300A,0115) shall be MV. If Radiation Type (300A,00C6) is ELECTRON, Nominal Beam Energy Unit (300A,0115) shall be MEV. Usage: Written and used by *syngo* RT Therapist
>>Wedge Position Sequence	(300A,0116)	3	Introduces sequence of Wedge positions for current control point. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist
>>>Referenced Wedge Number	(300C,00C0)	1C	Uniquely identifies wedge specified by Wedge Number (300A,00D2) within Beam referenced by Referenced Beam Number (300C,0006). Required if Wedge Position Sequence (300A,0116) is sent. Usage: Written and used by *syngo* RT Therapist
>>>Wedge Position	(300A,0118)	1C	Position of Wedge at current control point. Required if Wedge Position Sequence (300A,0116) is sent. Enumerated Values: IN, OUT. Usage: Written by *syngo* RT Therapist. Always IN if a wedge is present.
>>Beam Limiting Device Position Sequence	(300A,011A)	1C	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if beam limiting device (collimator) changes during beam administration. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist
>>>RT Beam Limiting Device Type	(300A,00B8)	1C	Type of beam limiting device. The value of this attribute shall correspond to RT Beam Limiting Device Type (300A,00B8) defined in an element of Beam Limiting Device Leaf Pairs Sequence (3008,00A0). Required if Beam Limiting Device Position Sequence (300A,011A) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction

Attribute Name	Tag	Type	Attribute Description
			ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction Usage: Written and used by *syngo* RT Therapist
>>>Leaf/Jaw Positions	(300A,011C)	1C	Positions of beam limiting device (collimator) leaf (element) or jaw pairs (mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g. X-axis for MLCX, Y-axis for MLCY. Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC) defined in element of Beam Limiting Device Leaf Pairs Sequence (3008,00A0). Values shall be in IEC leaf subscript order 101, 201, 102, 202, … 1N, 2N. Required if Beam Limiting Device Position Sequence (300A,011A) is sent. Usage: Written and used by *syngo* RT Therapist
>>Gantry Angle	(300A,011E)	1C	Treatment machine gantry angle, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Gantry Angle changes during beam administration. Usage: Written and used by *syngo* RT Therapist.
>>Gantry Rotation Direction	(300A,011F)	1C	Direction of Gantry Rotation when viewing gantry from isocenter, for segment beginning at current Control Point. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040), or if Gantry Rotation Direction changes during beam administration. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation Usage: Written and used by *syngo* RT Therapist. Always NONE except for ARC and Cone beams.
>>Beam Stopper Position	(3008,0230)	3	Position of Beam Stopper during beam administration. Enumerated Values: EXTENDED = Beam Stopper extended RETRACTED = Beam Stopper retracted UNKNOWN = Position unknown Usage: Not used
>>Beam Limiting Device Angle	(300A,0120)	1C	Beam Limiting Device (collimator) angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees). Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if beam limiting device (collimator) angle changes during beam delivery.

Attribute Name	Tag	Type	Attribute Description
			Usage: Written and used by *syngo* RT Therapist
>>Beam Limiting Device Rotation Direction	(300A,0121)	1C	Direction of Beam Limiting Device Rotation when viewing beam limiting device (collimator) from radiation source, for segment beginning at current Control Point. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Beam Limiting Device Rotation Direction changes during beam administration. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation Usage: Written and used by *syngo* RT Therapist
>>Patient Support Angle	(300A,0122)	1C	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT (turntable) coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees). Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Patient Support Angle changes during beam administration. Usage: Written and used by *syngo* RT Therapist
>>Patient Support Rotation Direction	(300A,0123)	1C	Direction of Patient Support Rotation when viewing table from above, for segment beginning at current Control Point. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040), or if Patient Support Rotation Direction changes during beam administration. Enumerated Values: CW = clockwise CC = counter-clockwise NONE = no rotation Usage: Written and used by *syngo* RT Therapist
>>Table Top Eccentric Axis Distance	(300A,0124)	3	Distance (positive) from the IEC PATIENT SUPPORT vertical axis to the IEC TABLE TOP ECCENTRIC vertical axis (mm). Usage: Written by *syngo* RT Therapist
>>Table Top Eccentric Angle	(300A,0125)	1C	Table Top (non-isocentric) angle, i.e. orientation of IEC TABLE TOP ECCENTRIC coordinate system with respect to IEC PATIENT SUPPORT coordinate system (degrees). Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Table Top Eccentric Angle changes during beam administration. Usage: Written by *syngo* RT Therapist
>>Table Top Eccentric Rotation Direction	(300A,0126)	1C	Direction of Table Top Eccentric Rotation when viewing table from above, for segment beginning at current Control Point. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Table Top Eccentric Rotation Direction changes during beam administration. Enumerated Values:

Attribute Name	Tag	Type	Attribute Description
			CW = clockwise CC = counter-clockwise NONE = no rotation Usage: Written by *syngo* RT Therapist.
>>Table Top Vertical Position	(300A,0128)	2C	Table Top Vertical position in IEC TABLE TOP coordinate system (mm). This value is interpreted as an absolute, rather than relative, Table setting. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Table Top Vertical Position changes during beam administration. Usage: Written and used by *syngo* RT Therapist
>>Table Top Longitudinal Position	(300A,0129)	2C	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm). This value is interpreted as an absolute, rather than relative, Table setting. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Table Top Longitudinal Position changes during beam administration. Usage: Written and used by *syngo* RT Therapist
>>Table Top Lateral Position	(300A,012A)	2C	Table Top Lateral position in IEC TABLE TOP coordinate system (mm). This value is interpreted as an absolute, rather than relative, Table setting. Required for Control Point 0 of Control Point Delivery Sequence (3008,0040) or if Table Top Lateral Position changes during beam administration. Usage: Written and used by *syngo* RT Therapist
>>Override Sequence	(3008,0060)	3	Introduces sequence of parameters which were overridden during the administration of the beam segment immediately prior to the current control point. The sequence may contain one or more items. Usage: Written and used by *syngo* RT Therapist
>>>Override Parameter Pointer	(3008,0062)	2C	Contains the Data Element Tag of the attribute which was overridden. Required if Override Sequence (3008,0060) is sent. Usage: Written and used by *syngo* RT Therapist
>>>Operator Name	(0008,1070)	2C	Name of operator who authorized override. Required if Override Sequence (3008,0060) is sent. Usage: Written and used by *syngo* RT Therapist. Refer to Section Operator Name Encoding in *syngo* RT Therapist.
>>>Override Reason	(3008,0066)	3	User-defined description of reason for override of parameter specified by Override Parameter Pointer (3008,0062). Usage: Written and used by *syngo* RT Therapist. *syngo* RT Therapist uses the override reason to document overrides to private attributes. Refer to Override Reason Encoding for details
>In Session Resumption UID	(See Appendix A)	3	This attribute contains a double number that is the value of the ColeDateTime value of the first delivery of the beam that was treated in

Attribute Name	Tag	Type	Attribute Description
			this session and is being resumed.
> Delivered Port Only	(See Appendix A)	3	This attribute specifies if the beam was delivered as a “Port-Only” beam.
> Node Imaging Connection	(See Appendix A)	3	This attribute contains a double number that is the value of the ColeDateTime value of the delivery of first segment of the beam.
Treatment_Notes	(See Appendix A)	3	Notes entered by the user at the end of a fraction’s treatment. The notes have the referenced fraction number as an attribute.
QA_Record	(See Appendix A)	3	This Boolean attribute identifies a QA record.
MANUAL_RECORD_OIS	(See Appendix A)	3	This Boolean attribute identifies a manual record from OIS

Override reason encoding

syngo RT Therapist-*syngo* uses the Override Reason (3008,0066) attribute to encode additional information about the overridden attribute. The override reason is formatted in the following format

-<<Prefix-<<Overridden values>-User Message

The identifier “Prefix” is used to point the actual attribute that was overridden when the DICOM attribute pointer is not sufficient . The prefix is mandatory for the attributes listed below:

ARC_ANGLE_OVERRIDE – Gantry Stop Angle override (for ARC beams)

BEAM_GATED_TO_NORMAL_OVERRIDE - Beam Technique; Planned was Gated; Actual is Normal

BEAM_NORMAL_TO_GATED_OVERRIDE - Beam Technique; Planned was Normal; Actual is Gated

BEAM_NORMAL_TO_STEREOTACTIC_OVERRIDE - Beam Technique; Planned was Normal; Actual is Streotactic

BEAM_STEREOTACTIC_TO_NORMAL_OVERRIDE - Beam Technique; Planned was Streotactic; Actual is Normal

MINIMUM_TIME_BETWEEN_FRACTIONS_OVERRIDE - Minimum Time Between Fractions

"Overridden values" is encoded as either <Planned / Actual> or <Actual> based on the parameter that is overridden. Note that *syngo* RT Therapist-*syngo* only writes this component and does not use it.

"User Message" component actually holds the user defined reason for the override. Note that the separator ">-" is mandatory.

A.7.22.1 Recording Verification Image Segments, Position Verification, and PORT_ONLY Beams

The delivery of the verification image segments of a treatment beam are recorded as separate Treatment Session Beam objects – separate from the treatment session beam object of the treatment segments of the beam. The *Treatment Delivery Type (300A, 00CE)* attribute of these '*verification image segment*' beams are set as specified below.

Number of Image exposures	Treatment Delivery Type
Single Exposure	TRMT_PORTFILM
Double Exposure	OPEN_PORTFILM

Table 12: Treatment Delivery Type in RT Beam Session Records

Such beam deliveries are not counted in delivery counting. See examples below.

A.7.22.2 Recording Beams with Portal Imaging

Treatment beams that contain pre-port /post-port portal imaging shall be recorded with each verification image segment and all the treatment segments stored as separate Treatment Session Beam record objects. These records shall be created in the sequence in which, the treatment and portal imaging segments were delivered.

Example: Beam Session Records generated by the *PRE_PORT Single* Treatment of a beam with 1 Treatment Segment of 20 MUs.

Treatment Session Beam Record
Tx Del Type: TRMT_PORTFILM Tx Term Status: NORMAL
Control Point Delivery Sequence For the ***portal imaging*** control points. CP 0 – Delivered Meterset – 0 CP 1 - Delivered Meterset – 2

Treatment Session Beam Record
Tx Del Type: TREATMENT Tx Term Status: NORMAL
Control Point Delivery Sequence For the treatment control points. CP 2 – Delivered Meterset – 0 CP n – Delivered Meterset – 20

Table 13: Tx Session Beam records for treatment beam with PRE_PORT single delivery

A.7.22.3 Aborted/Incomplete Treatments

A treatment session generates records pertaining to individual fractions of fraction groups that were delivered during the session. When these records are later retrieved, it is important to identify if the last session was incomplete/aborted. A treatment session is identified as incomplete/aborted if the fraction's delivery was marked incomplete in the treatment record.

Identification of Incomplete delivery:

- **A fraction:** of a fraction group that was delivered in the session is considered incomplete if the 'Treatment Termination Status' of that fraction in the fraction status summary sequence of the fraction group (in Treatment Summary Record.) is *not* set to NORMAL (i.e. it is set to– MACHINE / UNKNOWN / OPERATOR).
- **A beam:** is treated as incomplete if, in the Beam session record, the treatment termination status of a beam is *not* set to NORMAL (i.e. it is set to– MACHINE / UNKNOWN / OPERATOR).

  Note: The Verification image segment records are ignored during determination of a successful delivery of the beam. i.e. A beam whose verification image segments were not delivered successfully does not constitute an incomplete beam.

- **A control point:** is treated as incomplete if, in the Beam session record's control point delivery sequence, the 'Delivered Meterset' attribute is not equal to the 'Specified Meterset'.

  Note: A fraction of a fraction group is deemed incomplete only if the fraction is marked incomplete. If the treatment termination status of the fraction is set to NORMAL, the fraction is assumed to be complete even if there are beams/control points that have not been completely delivered.

A.7.22.4 Creation of Treatment Beam Record IOD

The RT Beam Session record is created as part of a RT Beam Treatment Record IOD. A Beam Treatment Record IOD object is created after the delivery of the first segment of the first delivered beam of a fraction group. It is updated as each segment in each beam is delivered till finally, it contains all the beams that were treated for that fraction of the fraction group. After the completion of the session, the instance UID of the RT Treatment Summary Record object is inserted into the referenced treatment record sequence of the RT General Treatment record module of this RT Beam Treatment Record object. This is done for all the RT Beam Treatment Records created in this session. In this manner, each treatment beam record IOD object will always reference the summary record IOD object that was created for that session.

A.7.22.5 Patient Setup Recording

syngo RT Therapist-*syngo* tracks the setup of the patient in a session using the RT Patient Setup module within the RT Beams Treatment Record IOD. The setup tracking information is maintained as follows:

1. A new patient setup is created for every new setup beam delivered.
2. For every new fraction group treated in the session after the initial setup, a new patient setup module shall be created in the corresponding Beams treatment record. Note that while this is a new setup object, it represents the same patient setup.
3. If positioning offsets are applied immediately after setup beam delivery, then the current setup is updated to add the positioning offsets. (i.e. the positioning beams delivered after the setup beam shall reference the setup containing the positioning offsets.)
4. If positioning offsets are applied immediately after one or more treatment beams were delivered in the current setup, then a new setup is created with only positioning offsets. (If no setup beam was delivered immediately preceding the delivery of the positioning beams, the setup offsets are not recorded in the new patient setup.) Also, all the position verification beams delivered to calculate the positioning offset shall reference this setup containing only the positioning offsets.
5. If the user delivers a positioning beam, then a new setup shall be created even if the user decides not to apply the positioning offset calculated. Such a setup shall not contain any offsets.
6. Position verification beams shall always reference a patient setup object in the records.

Examples of Treatment Record Creation in *syngo* RT Therapist

A.7.22.5.1 Beams Treatment Record for a Fixed Beam, No Portal Imaging

Planned sequence:

Fraction Group Number	Number Of Beams	Referenced Beam Number(s)
1	1	1

Beam Number:	1	
Beam Description:	Fixed Beam with no portal imaging containing a single segment delivering 20 MUs.	
Segment #	**MUs Planned**	**Portal Imaging Segment**
1	20	No

Scenario:

First attempted delivery of a beam for a fraction group # 1. The beam is treated successfully.

Generated Treatment Records: (relevant attributes only)

RT Tx Summary Record Module:

Current Treatment Status	ON_TREATMENT

Fraction Group Summary Record:

Referenced Fraction Group Number	1
Number Of Fractions Delivered	1

Fraction Status Summary Record:

Referenced Fraction Number	1
Treatment Termination Status	NORMAL

Treatment Session Beam Record

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20

A.7.22.5.2 PRE_PORT Double Fixed Beam

Planned sequence:

Fraction Group Number	Number Of Beams	Referenced Beam Number(s)
1	1	1

Beam Number:	1	
Beam Description:	Fixed Beam with pre_port, double portal imaging containing a single treatment segment delivering 20 MUs.	
Segment #	MUs Planned	Portal Imaging Segment
1	2	Yes (Treatment Port)
2	2	Yes (Open Port)
3	20	No

Scenario:

First attempted delivery of the pre-port, fixed beam. The beam is treated successfully.

Generated Treatment Records: (relevant attributes only)

RT Tx Summary Record Module:

Current Treatment Status	ON_TREATMENT

Fraction Group Summary Record:

Referenced Fraction Group Number	1
Number Of Fractions Delivered	1

Fraction Status Summary Record:

Referenced Fraction Number	1
Treatment Termination Status	NORMAL

Treatment Session Beam Records:

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TRMT_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		2	2

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	OPEN_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
2		2	2
3		4	4

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
4		0	0
5		20	20

A.7.22.5.3 POST_PORT, Single IMRT Beam

Planned sequence:

Fraction Group Number	Number Of Beams	Referenced Beam Number(s)
1	1	1

Beam Number:	1	
Beam Description:	Fixed Beam with post_port, single portal imaging with 3 treatment segments of 20, 10 and 5 MUs respectively.	
Segment #	**MUs Planned**	**Portal Imaging Segment**
1	20	No
2	10	No
3	5	No
4	2	Yes (Treatment Port)

Generated Treatment Records: (relevant attributes only)

RT Tx Summary Record Module:

Current Treatment Status	ON_TREATMENT

Fraction Group Summary Record:

Referenced Fraction Group Number	1
Number Of Fractions Delivered	1

Fraction Status Summary Record:

Referenced Fraction Number	1
Treatment Termination Status	NORMAL

Treatment Session Beam Records:

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20
2		20	20
3		30	30
4		30	30
5		35	35

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TRMT_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
6		0	0
7		2	2

A.7.22.5.4 Incomplete Fraction with Entire Beams Undelivered

Planned sequence:

Fraction Group Number	Number Of Beams	Referenced Beam Number(s)
1	1	1, 2, 3

Beam Number:	1	
Beam Description:	Fixed Beam with pre_port, double portal imaging containing a single treatment segment delivering 20 MUs.	
Segment #	**MUs Planned**	**Portal Imaging Segment**
1	2	Yes (Treatment Port)
2	2	Yes (Open Port)
3	20	No

Beam Number:	2	
Beam Description:	Fixed Beam with no portal imaging containing a single segment delivering 20 MUs.	
Segment #	**MUs Planned**	**Portal Imaging Segment**
1	20	No

Beam Number:	3	
Beam Description:	Fixed Beam with no portal imaging containing a single segment delivering 30 MUs.	
Segment #	**MUs Planned**	**Portal Imaging Segment**
1	30	No

Scenario:

The fraction was delivered completely once. In the next session, during the second fraction, only Beams 1 and 2 were delivered.

Resumption Objects identified in next session (assuming no change of plan versions.):

i. Fraction group 1. (As fraction 2 has “Treatment Termination Status” set to “OPERATOR” as shown below.
ii. Beam 3. As it was not delivered for the fraction # 2. The resumption point shall be identified as the start of the current beam.

Generated Treatment Records: (relevant attributes only)

RT Tx Summary Record Module:

Current Treatment Status	ON_TREATMENT

Fraction Group Summary Record:

Referenced Fraction Group Number	1
Number Of Fractions Delivered	2

Fraction Status Summary Records:

Fraction Status Summary Record for 1st Session:

Referenced Fraction Number	1
Treatment Termination Status	NORMAL

Fraction Status Summary Record for 2nd Session:

Referenced Fraction Number	2
Treatment Termination Status	OPERATOR

Beams Session Record for 1st Session: (Treatment Session Beams)

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TRMT_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		2	2

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	OPEN_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
2		2	2
3		4	4

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
2	1	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
3	1	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		30	30

Beam Session Record for 2nd Session: (Treatment Session Beams)

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	2	TRMT_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		2	2

Ref. Beam #	**Curr Fraction#**	**Tx Delivery Type**	**Tx Termination Status**
1	2	OPEN_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
2		2	2
3		4	4

Ref. Beam #	**Curr Fraction#**	**Tx Delivery Type**	**Tx Termination Status**
1	2	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20

Ref. Beam #	**Curr Fraction#**	**Tx Delivery Type**	**Tx Termination Status**
2	2	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20

A.7.22.6 Resumption Records and Partially Delivered Beams

Consider a continuation of the planned sequence in example A.7.22.5.4.

Scenario:

At the end of scenario in A.7.22.5.4 above, beam 3 needs to be resumed to complete fraction 2 of the fraction group.

In the next session, the following treatment is now delivered:

- Fraction 2 is resumed successfully (i.e. Beam 3 is delivered completely).
- The entire Beam 3 is successfully delivered again.
- Beam 2 is delivered partially terminating due to an operator cancellation in the middle of segment 1 (after 10 MUs have been delivered.)
- Beam 1 is delivered partially terminating with a machine interlock in segment 2 (the open port segment)

The new and modified treatment records generated shall be as shown below.

Resumption Objects identified in next session:

iii. Fraction group 1. (As fraction 3 has “Treatment Termination Status” set to “MACHINE” as shown below.
iv. Beam 2. (As it was partially delivered for fraction 3. Resumption point shall be identified as the point in the treatment segment where the interrupt occurred. I.e. 10 MUs into the segment.)
v. Beam 1. (As it too was partially delivered for fraction 3. Resumption point shall be identified as the start of the beam as the interrupt occurred during delivery of a verification image segment.)

Generated Treatment Records: (relevant attributes only)

RT Tx Summary Record Module:

Current Treatment Status	ON_TREATMENT

Fraction Group Summary Record:

Referenced Fraction Group Number	1
Number Of Fractions Delivered	3

Fraction Status Summary Records:

Both the following fraction status summary records are generated in the same session.

Referenced Fraction Number	2
Treatment Termination Status	NORMAL

Referenced Fraction Number	3
Treatment Termination Status	MACHINE

Note: At this point, there will be two fraction status summary records for fraction number 2. The first one, from the previous session, shall have the Treatment Termination Status set to OPERATOR and the second, from the current session, shall have NORMAL (representing the resumption.)

Beam Session Record: (Treatment Session Beams)

Successful resumption of Beam 3 for fraction 2 from end of scenario in A.7.22.5.4

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
3	2	CONTINUATION	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		30	30

Successful treatment of Beam 3 for fraction 3

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
3	3	TREATMENT	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		30	30

Partial delivery of beam 2

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
2	3	TREATMENT	OPERATOR
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	**10**

Partial delivery of the beam 1

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	3	TRMT_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		2	2

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	OPEN_PORTFILM	**MACHINE**
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
2		2	2
3		4	3

A.7.22.6.1 Partial Delivery of a Beam Followed by an In-Session Resumption

Planned sequence:

Fraction Group Number	Number Of Beams	Referenced Beam Number(s)
1	1	1

Beam Number:	1	
Beam Description:	Fixed Beam with pre_port, double portal imaging containing a single treatment segment delivering 20 MUs.	
Segment #	**MUs Planned**	**Portal Imaging Segment**
1	20	No
2	10	No
3	5	No
4	2	Yes (Treatment Port)

Scenario:

As part of the 1st fraction, Beam 1 is delivered partially. Then it is resumed successfully within the same session.

Resumption Objects identified in next session: None. (As the last delivery of beam 1 was a successful resumption.)

Generated Treatment Records: (relevant attributes only)

RT Tx Summary Record Module:

Current Treatment Status	ON_TREATMENT

Fraction Group Summary Record:

Referenced Fraction Group Number	1
Number Of Fractions Delivered	1

Fraction Status Summary Record:

Referenced Fraction Number	1
Treatment Termination Status	NORMAL

Beam Session Record: (Treatment Session Beam Records)

Partial delivery of Beam 1

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TREATMENT	OPERATOR
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	0
1		20	20
2		20	20
3		30	20
4		30	20
5		35	20

Resumed beam:

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	CONTINUATION	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
0		0	20
1		20	20
2		20	20
3		30	30
4		30	30
5		35	35

Ref. Beam #	Curr Fraction#	Tx Delivery Type	Tx Termination Status
1	1	TRMT_PORTFILM	NORMAL
Referenced CP Index		**Specified Meterset**	**Delivered Meterset**
6		0	0
7		2	2

A.7.23 Calculated Dose Reference Record Module

Attribute Name	Tag	Type	Attribute Description
Calculated Dose Reference Sequence	(3008,0070)	1	Introduces sequence of doses estimated for each treatment delivery. The sequence may contain one or more items. Usage: Written & Used by *syngo* RT Therapist
>Referenced Dose Reference Number	(300C,0051)	1C	Uniquely identifies Dose Reference specified by Dose Reference Number (300A, 0012) in Dose Reference Sequence (300A, 0010) in RT Prescription Module of referenced RT Plan. Required only if Calculated Dose Reference Number (3008,0072) is not sent. It shall not be present otherwise. Usage: Written & Used by *syngo* RT Therapist
>Calculated Dose Reference Number	(3008,0072)	1C	Unique identifier of dose reference point within RT Treatment Record IOD. Required only if Referenced Dose Reference Number (300C,0051) is not sent. It shall not be present otherwise.
>Calculated Dose Reference Dose Value	(3008,0076)	2	Calculated Dose (Gy). Usage: Written & Used by *syngo* RT Therapist. Calculated from the delivered control points (that reference this dose reference) of the beam.
>Calculated Dose Reference Description	(3008,0074)	3	User-defined description of Calculated Dose Reference. Usage: Written & Used by *syngo* RT Therapist. This value is picked up from the Dose Reference description of the corresponding dose reference object in the RT prescription module.

A.7.24 RT Treatment Machine Record

Attribute Name	Tag	Type	Attribute Description
Treatment Machine Sequence	(300A,0206)	1	Introduces sequence describing treatment machine used for treatment delivery. Only a single Item shall be permitted in this Sequence. Usage: Used and written.
>Treatment Machine Name	(300A,00B2)	2	User-defined name identifying treatment machine used for treatment delivery. Usage: Used and written.
>Manufacturer	(0008,0070)	2	Manufacturer of the equipment used for treatment delivery. Usage: Used and written.
>Institution Name	(0008,0080)	2	Institution where the equipment is located that was used for treatment delivery. Usage: Used and written.
>Institution Address	(0008,0081)	3	Mailing address of the institution where the equipment is located that was used for treatment delivery. Usage: Used and written.
>Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment is located that was used for treatment delivery. Usage: Used and written.
>Manufacturer's Model Name	(0008,1090)	2	Manufacturer's model name of the equipment used for treatment delivery. Usage: Used and written.
>Device Serial Number	(0018,1000)	2	Manufacturer's serial number of the equipment used for treatment delivery. Usage: Used and written.

A.7.25 Structured Reports

syngo RT Therapist generates the following three types of structured reports to maintain/transfer the information:

a. Plan Action Status Structured Report: This report is generated by *syngo* RT Therapist to store
   - Dose alert acknowledgements and
   - The current print status for update printing of the patient treatment chart report.

b. Position Correction Report (PCR): This report contains the position correction offsets that were calculated and applied per user per treatment session. For details on the PCR, refer [**Fehler! Verweisquelle konnte nicht gefunden werden.**].

c. Treatment Review Report: This reports contains the results of an oncologist's review session. An oncologist reviews and verifies portal images and/or PCRs. For details on the Treatment Review Report, refer [**Fehler! Verweisquelle konnte nicht gefunden werden.**].

A.7.25.1 Format of Structured Reports

The Structured Reports generated by Coherence have the following properties:

a. The report content is stored within a private attribute - tag (0029, 1010)
b. The report content tree is organized into a single XML stream.

A.7.25.2 Structured Report Private Attribute

Attribute Name	Tag	Type	Attribute Description
syngo Report Data	(0029,1010)		Usage: Contains a single XML stream that contains the content tree of the Structured Report.

A.7.25.3 SR Document General Module

Attribute Name	Tag	Type	Attribute Description
Instance Number	(0020,0013)	1	A number that identifies the SR Document. Usage: Used and written by *syngo* RT Therapist.
Completion Flag	(0040,A491)	1	The estimated degree of completeness of this SR Document with respect to externally defined criteria in a manner specified in the Conformance Statement. Note: It may be desirable to make these criteria adaptable to local policies or user decisions. Enumerated Values: PARTIAL = Partial content. COMPLETE = Complete content. Usage: Always COMPLETE
Completion Flag Description	(0040,A492)	3	Explanation of the value sent in Completion Flag (0040,A491).
Verification Flag	(0040,A493)	1	Indicates whether this SR Document is Verified. Enumerated Values: UNVERIFIED = Not attested to. VERIFIED = Attested to by a Verifying Observer Name (0040,A075) who is accountable for its content. Note: The intent of this specification is that the "prevailing final version" of an SR Document is the version having the most recent Verification DateTime (0040,A030), Completion Flag (0040,A491) of COMPLETE and Verification Flag (0040,A493) of VERIFIED. Usage: UNVERIFIED

Content Date	(0008,0023)	1	The date the document content creation started. Usage: Used and written by *syngo* RT Therapist.
Content Time	(0008,0033)	1	The time the document content creation started. Usage: Used and written by *syngo* RT Therapist.
Verifying Observer Sequence	(0040,A073)	1C	The person or persons authorized to verify documents of this type and accept responsibility for the content of this document. One or more Items may be included in this sequence. Required if Verification Flag (0040,A493) is VERIFIED. Usage: Not Used
>Verifying Observer Name	(0040,A075)	1	The person authorized by the Verifying Organization (0040,A027) to verify documents of this type and who accepts responsibility for the content of this document. Usage: Not Used
>Verifying Observer Identification Code Sequence	(0040,A088)	2	Coded identifier of Verifying Observer. Zero or one Items shall be permitted in this sequence. Usage: Not Used
>Verifying Organization	(0040,A027)	1	Organization to which the Verifying Observer Name (0040,A075) is accountable for this document in the current interpretation procedure. Usage: Not Used
>Verification DateTime	(0040,A030)	1	Date and Time of verification by the Verifying Observer Name (0040,A075). Usage: Not Used
Predecessor Documents Sequence	(0040,A360)	1C	Shall refer to SR SOP Instances (e.g. prior or provisional reports) whose content has been wholly or partially included in this document with or without modification. One or more Items may be included in this sequence. Required if this document includes content from other documents. Note: The amendment process of an existing SR Document is not explicitly described, but several approaches may be considered. One may choose, for example, to create a new SR Document that includes the original content with any amendments applied or included. The structure of this amended SR Document may or may not reflect what was amended. However, the use of the Predecessor Document Sequence allows tracing back to the input SR Document, which in this case is the previous version. Usage: Used and written by *syngo* RT Therapist. Only one entry referencing the immediate Predecessor document shall be referenced.
>Include 'SOP Instance Reference Macro'			
Identical Documents Sequence	(0040,A525)	1C	Duplicates of this document, stored with different SOP Instance UIDs. One or more Items may be included in this sequence. Required if this document is stored with different SOP Instance UIDs in one or more other Studies. Usage: Not used.
Referenced Request Sequence	(0040,A370)	1C	Identifies Requested Procedures which are being fulfilled (completely or partially) by creation of this Document. One or more Items may be included in this sequence. Required if this Document fulfills at least one Requested Procedure. Usage: Not used.
Performed Procedure Code Sequence	(0040,A372)	2	A Sequence that conveys the codes of the performed procedures pertaining to this SOP Instance. Zero or more Items may be included in this sequence. Usage: Not used.

Current Requested Procedure Evidence Sequence	(0040,A375)	1C	Full set of Composite SOP Instances created to satisfy the current Requested Procedure(s) for which this SR Document is generated. One or more Items may be included in this sequence. Required if Composite Objects were acquired in order to satisfy the Requested Procedure(s) for which the SR Document is generated and Completion Flag (0040,A491) value is COMPLETE. May be present otherwise. Usage: Not used.
Pertinent Other Evidence Sequence	(0040,A385)	1C	Other Composite SOP Instances that are considered to be pertinent evidence by the creator of this SR Document. This evidence must have been acquired in order to satisfy Requested Procedures other than the one(s) for which this SR Document is generated. One or more Items may be included in this sequence. Required if pertinent evidence from other Requested Procedures needs to be recorded. Usage: Not used.

A.7.25.4 SR Document Content Module

Attribute Name	Tag	Type	Attribute Description
Value Type	(0040,A040)	1	The type of the value encoded in this Content Item. Defined Terms: TEXT NUM CODE DATETIME DATE TIME UIDREF PNAME COMPOSITE IMAGE WAVEFORM SCOORD TCOORD CONTAINER Usage : Always CONTAINER
Concept Name Code Sequence	(0040,A043)	1C	Code describing the concept represented by this Content Item. Also conveys the value of Document Title and section headings in documents. Only a single Item shall be permitted in this sequence. Required if Value Type (0040,A040) is TEXT or NUM or CODE or DATETIME or DATE or TIME or UIDREF or PNAME. Required if Value Type (0040,A040) is CONTAINER and a heading is present, or this is the Root Content Item. Note: That is, containers without headings do not require Concept Name Code Sequence Required if Value Type (0040,A040) is COMPOSITE, IMAGE, WAVEFORM, SCOORD or TCOORD, and the Purpose of Reference is conveyed in the Concept Name. Usage: Not used.

Attribute Name	Tag	Type	Attribute Description
Continuity of Content	(0040,A050)	1C	This flag specifies for a CONTAINER whether or not its contained Content Items are logically linked in a continuous textual flow, or are separate items. Required if Value Type (0040,A040) is CONTAINER. Enumerated Values: SEPARATE CONTINUOUS Usage: Always SEPARATE
Text Value	(0040,A160)	1C	This is the value of the Content Item. Required if Value Type (0040,A040) is TEXT. Text data which is unformatted and whose manner of display is implementation dependent. The text value may contain spaces, as well as multiple lines separated by either LF, CR, CR LF or LF CR, but otherwise no format control characters (such as horizontal or vertical tab and form feed) shall be present, even if permitted by the Value Representation of UT. The text shall be interpreted as specified by Specific Character Set (0008,0005) if present in the SOP Common Module. Usage: Used and written by *syngo* RT Therapist
DateTime	(0040,A120)	1C	This is the value of the Content Item. Required if Value Type (0040,A040) is DATETIME. Usage: Not used
Date	(0040,A121)	1C	This is the value of the Content Item. Required if Value Type (0040,A040) is DATE. Usage: Not used
Time	(0040,A122)	1C	This is the value of the Content Item. Required if Value Type (0040,A040) is TIME. Usage: Not used
Person Name	(0040,A123)	1C	This is the value of the Content Item. Required if Value Type (0040,A040) is PNAME. Usage: Not used
UID	(0040,A123)	1C	This is the value of the Content Item. Required if Value Type (0040,A040) is UIDREF. Usage: Not used

A.7.25.5 Coherence Structure Report XML Structure

As described above, all the SR report content shall be stored within a single private attribute viz. (0029,1010). This attribute contains the report data stored as a single XML stream. This section defines the XML structure of each of the three SR report types generated by *syngo* RT Therapist.

A.7.25.5.1 Plan Action Status Structured Report

The plan action status contains the two sets of information. Viz.:

1. Dose alert acknowledgements and
2. The current print status for update printing of the patient treatment chart report.

This report shall be created on a per plan basis for each treatment session.

It is expected that the OIS shall read the dose alert acknowledgments in this report and update its dose alert status information. The dose alert acknowledgments are stored cumulatively in the Plan Action Status SR i.e. the latest SR will contain all dose alert acknowledgments done for the particular plan chain.

The print status related information is used internally by *syngo* RT Therapist.

XML Schema of Plan Action Status SR Report:

```
<?xml version="1.0" encoding="utf-8"?>
<xs: schema id="PlanActionStatusStructuredReport"
targetNamespace="http://www.siemens.com/med/ocs/DICOM/2007/10/18/PlanActionStatusStructuredReport.xsd"
xmlns="http://www.siemens.com/med/ocs/DICOM/2007/10/18/PlanActionStatusStructuredReport.xsd"
xmlns:mstns="http://www.siemens.com/med/ocs/DICOM/2007/10/18/PlanActionStatusStructuredReport.xsd"
xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="RT_Plan_Action_Status_SR_Document">
  <xs:complexType>
   <xs:sequence>
    <xs:element name="Referenced_Plan" minOccurs="1" maxOccurs="1">
     <xs:complexType>
      <xs:sequence>
       <xs:element name="Plan_Label" type="xs:string" minOccurs="1" maxOccurs="1" />
       <xs:element name="Referenced_Plan_Version_UID" type="xs:string" minOccurs="1" maxOccurs="1" />
      </xs:sequence>
     </xs:complexType>
    </xs:element>
    <xs:element name="Dose_Alert_Acknowledgements" minOccurs="0" maxOccurs="1">
     <xs:complexType>
      <xs:sequence>
       <xs:element name="Dose_Reference" minOccurs="1" maxOccurs="1">
        <xs:complexType>
         <xs:sequence>
          <xs:element name="Lead_Dose_Alert_Acknowledgements" minOccurs="0" maxOccurs="unbounded">
           <xs:complexType>
            <xs:sequence>
             <xs:element name="Dose_Alert_Acknowledgment_Container"
type="Dose_Acknowledgement_Container_Type" minOccurs="1" maxOccurs="unbounded" />
            </xs:sequence>
           </xs:complexType>
          </xs:element>
          <xs:element name="Warning_Dose_Alert_Acknowledgements" minOccurs="0" maxOccurs="unbounded">
           <xs:complexType>
            <xs:sequence>
             <xs:element name="Dose_Alert_Acknowledgment_Container"
type="Dose_Acknowledgement_Container_Type" minOccurs="1" maxOccurs="unbounded" />
            </xs:sequence>
           </xs:complexType>
          </xs:element>
          <xs:element name="Dose_Reference_Number" type="xs:string" minOccurs="1" maxOccurs="1" />
         </xs:sequence>
        </xs:complexType>
       </xs:element>
      </xs:sequence>
     </xs:complexType>
```

```
      </xs:element>
      <xs:element name="Patient_Treatment_Chart_Status" minOccurs="0" maxOccurs="1">
       <xs:complexType>
        <xs:sequence>
         <xs:element name="Last_Printer_Configuration_Change" type="xs:string" minOccurs="1" maxOccurs="1" />
         <xs:element name="Start_Row_Number" type="xs:unsignedByte" minOccurs="1" maxOccurs="1" />
         <xs:element name="Start_Page_Number" type="xs:unsignedByte" minOccurs="1" maxOccurs="1" />
         <xs:element name="Report_Template_Last_Modification_Date_Time" type="xs:string" minOccurs="1"
maxOccurs="1" />
         <xs:element name="Tx_Chart_First_Print_Date_Time" type="xs:string" minOccurs="1" maxOccurs="1" />
         <xs:element name="Tx_Chart_Last_Print_Date_Time" type="xs:string" minOccurs="1" maxOccurs="1" />
         <xs:element name="Tx_Chart_Start_Date_Time" type="xs:string" minOccurs="1" maxOccurs="1" />
         <xs:element name="Report_Template_Name" type="xs:string" minOccurs="1" maxOccurs="1" />
        </xs:sequence>
       </xs:complexType>
      </xs:element>
     </xs:sequence>
    </xs:complexType>
   </xs:element>
   <xs:complexType name="Dose_Acknowledgement_Container_Type">
    <xs:sequence>
     <xs:element name="Dose_Level" type="xs:string" minOccurs="1" maxOccurs="1" />
     <xs:element name="Acknowledgement_Date_Time" type="xs:string" minOccurs="1" maxOccurs="1" />
     <xs:element name="Acknowledging_User" type="xs:string" minOccurs="1" maxOccurs="1" />
    </xs:sequence>
   </xs:complexType>
</xs:schema>
```

A.7.26 RT Image Attributes

The following table enumerates the RT Image attributes that Image Acquisition in *syngo* RT Therapist supports. Values that are in bold face are actual values (most often from enumerated values specified by DICOM). Italicized values are given by Treatment Delivery subsystem. Underlined values are described below in subsequent discussions.

A.7.26.1 General Image Module

The general image module is the base for the RT image.

Attribute Name	Tag	Type	Attribute Description	Notes
Instance Number	(0020,0013)	2	A number that identifies this image.	Filled sequentially, starting at 0.
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. Required if image does not require Image Orientation (Patient) (0020,0037) and Image Position (Patient) (0020,0032).	PatientOrientation (For Cone Beam Projections) Not Used for Portal Images.
Content Date	(0008,0023)	2C	The date the image pixel data creation started. Required if image is part of a series in which the images are temporally related. Note: This Attribute was formerly known as Image Date.	The date that the image is created.
Content Time	(0008,0033)	2C	The time the image pixel data creation started. Required if image is part of a series in which the images are temporally related.	The time that the image is created.
Image Type	(0008,0008)	3	Image identification characteristics.	ORIGINAL, PRIMARY
Acquisition Number	(0020,0012)	3	A number identifying the single continuous gathering of data over a period of time, which resulted in this image.	Not Used.
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started	The date that the image is created.
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started	The time that the image is created.
Acquisition Datetime	(0008,002A)	3	The date and time that the acquisition of data that resulted in this image started. Note: The synchronization of this time with an external clock is specified in the Synchronization Module in Acquisition Time Synchronized (0018,1800).	Not Used.
Referenced Image Sequence	(0008,1140)	3	A sequence which provides reference to a set of Image SOP Class/Instance identifying other images significantly related to this image (e.g. post-localizer CT image or Mammographic biopsy or partial view images)	Not used.

Attribute Name	Tag	Type	Attribute Description	Notes
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Image Sequence (0008,1140) is sent.	Not used.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Reference Image Sequence (0008,1140) is sent.	Not used.
>Referenced Frame Number	(0008,1160)	3	References one or more image frames of a Multi-frame Image SOP Instance, identifying which frames are significantly related to this image.	Not used.
Derivation Description	(0008,2111)	3	A text description of how this image was derived.	Used if content equals "PRESENTATION". Image is identified as presentation image.
Source Image Sequence	(0008,2112)	3	A Sequence, which identifies the set of Image SOP Class/Instance pairs of the Images, which were used to derive this Image. Zero or more Items may be included in this Sequence.	Not Used.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Source Image Sequence (0008,2112) is sent.	Not Used.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Source Image Sequence (0008,2112) is sent.	Not Used.
>Referenced Frame Number	(0008,1160)	3	References one or more image frames of a Multi-frame Image SOP Instance, identifying which frames were used to derive this image.	Not Used.
Images in Acquisition	(0020,1002)	3	Number of images that resulted from this acquisition of data	Not used.
Image Comments	(0020,4000)	3	User-defined comments about the image	Not used.
Quality Control Image	(0028,0300)	3	Indicates whether or not this image is a quality control or phantom image. Enumerated Values: YES NO If this Attribute is absent, then the image may or may not be a quality control or phantom image.	NO YES
Burned In Annotation	(0028,0301)	3	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired. Enumerated Values: YES NO If this Attribute is absent, then	NO

Attribute Name	Tag	Type	Attribute Description	Notes
			the image may or may not contain burned in annotation.	
Lossy Image Compression	(0028,2110)	3	Specifies whether an Image has undergone lossy compression. Enumerated Values: 00 = Image has NOT been subjected to lossy compression. 01 = Image has been subjected to lossy compression.	00
Lossy Image Compression Ratio	(0028,2112)	3	Describes the approximate lossy compression ratio(s) that have been applied to this image. May be multivalued if successive lossy compression steps have been applied. Notes: 1. For example, a compression ratio of 30:1 would be described in this Attribute with a single value of 30. 2. For historical reasons, the lossy compression ratio should also be described in Derivation Description (0008,2111).	Not used.
Icon Image Sequence	(0088,0200)	3	This icon image is representative of the Image.	Not used.
> Image Pixel Module				See Image Pixel section
Presentation LUT Shape	(2050,0020)	3	When present, specifies an identity transformation for the Presentation LUT such that the outputs of all grayscale transformations, if any, are defined to be in P-Values.	Not used.

A.7.26.2 Image Pixel Module

Attribute Name	Tag	Type	Attribute Description	Notes
Samples per Pixel	(0028, 0002)	1	Number of samples (planes) in this image.	1
Photometric Interpretation	(0028, 0004)	1	Specifies the intended interpretation of the pixel data.	MONOCHROME2
Rows	(0028, 0010)	1	Number of rows in the image.	Determined from the Imaging Hardware Parameters
Columns	(0028, 0011)	1	Number of columns in the image.	Determined from the Imaging Hardware Parameters
Bits Allocated	(0028, 0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated.	Determined from the Imaging Hardware Parameters
Bits Stored	(0028, 0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored.	Determined from the Imaging Hardware Parameters
High Bit	(0028, 0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.	Determined from the Imaging Hardware Parameters

Attribute Name	Tag	Type	Attribute Description	Notes
Pixel Representation	(0028, 0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated values: 0000H = unsigned integer 0001H = 2's complement	0000H
Pixel Data	(7FE0, 0010)	1	A data stream of the pixel samples that comprise the Image.	Data that is acquired from the Imaging Hardware.
Planar Configuration	(0028, 0006)	1C	Indicates whether the pixel data are sent color-by-plane or color-by-pixel. Required if Samples per Pixel (0028,0002) has a value greater than 1.	Not used.
Pixel Aspect Ratio	(0028, 0034)	1C	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value is the vertical pixel size, and the second value is the horizontal pixel size. Required if the aspect ratio is not 1\1 and the Image Plane Module is not applicable to this Image.	Not used.
Smallest Image Pixel Value	(0028, 0106)	3	The minimum actual pixel value encountered in this image.	Not used.
Largest Image Pixel Value	(0028, 0107)	3	The maximum actual pixel value encountered in this image.	Not used.
Some Palette attributes only required if Photometric Interpretation is PALETTE_COLOR	(0028, 1101) (0028, 1102) (0028, 1103) (0028, 1201) (0028, 1202) (0028, 1203)	3	Specifies color palette look up tables.	Not used.

A.7.26.3 RT Image Module

Attribute Name	Tag	Type	Attribute Description	Notes
Samples per Pixel	(0028, 0002)	1	Number of samples (planes) in this image.	In *syngo*, stored in the Image Pixel module.
Photometric Interpretation	(0028, 0004)	1	Specifies the intended interpretation of the pixel data.	In *syngo*, stored in the Image Pixel module.
Bits Allocated	(0028, 0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated.	In *syngo*, stored in the Image Pixel module.
Bits Stored	(0028, 0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored.	In *syngo*, stored in the Image Pixel module.
High Bit	(0028, 0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.	In *syngo*, stored in the Image Pixel module.
Pixel Representation	(0028, 0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated values: 0000H = unsigned integer 0001H = 2's complement	In *syngo*, stored in the Image Pixel module.

Attribute Name	Tag	Type	Attribute Description	Notes
RT Image Label	(3002,0002)	1	User-defined label for RT Image.	Determined using the BeamName and Beam ID.
RT Image Name	(3002,0003)	3	User-defined name for RT Image.	ImageName
RT Image Description	(3002,0004)	3	User-defined description of RT Image.	Not Used.
Operators' Name	(0008,1070)	2	Name of operator(s) acquiring or creating RT Image.	OperatorName
Image Type	(0008,0008)	1	Image identification characteristics (see Section C.7.6.1.1.2). RT Images shall use one of the following Defined Terms for Value 3: DRR = digitally reconstructed radiograph PORTAL = digital portal image or portal film image SIMULATOR = conventional simulator image RADIOGRAPH = radiographic image BLANK = image pixels set to background value	PORTAL
Conversion Type	(0008,0064)	2	Describes the kind of image conversion. Defined Terms: DV = Digitized Video DI = Digital Interface DF = Digitized Film WSD = Workstation	DI
Reported Values Origin	(3002,000A)	2C	Describes the origin of the parameter values reported in the image. Required if Value 3 of Image Type (0008,0008) is SIMULATOR or PORTAL. Enumerated Values: OPERATOR = manually entered by operator PLAN = planned parameter values ACTUAL = electronically recorded	ACTUAL
RT Image Plane	(3002,000C)	1	Describes whether or not image plane is normal to beam axis. Enumerated Values: NORMAL = image plane normal to beam axis NON_NORMAL = image plane non-normal to beam axis	NORMAL
X-Ray Image Receptor Translation	(3002,000D)	3	Position in (x,y,z) coordinates of origin of IEC X-RAY IMAGE RECEPTOR System in the IEC GANTRY coordinate system (mm).	Determined using epidX, epidY, SAD SID and Flat Panel alignment offset.
X-Ray Image Receptor Angle	(3002,000E)	2	X-Ray Image Receptor Angle i.e. orientation of IEC X-RAY IMAGE RECEPTOR coordinate system with respect to IEC GANTRY coordinate system (degrees).	Determined using Flat Panel alignment offset..
RT Image Orientation	(3002,0010)	2C	The direction cosines of the first row and the first column with respect to the IEC X-RAY IMAGE RECEPTOR coordinate system. Required if RT Image Plane (3002,000C) is NON_NORMAL.	Not Used.
Image Plane Pixel Spacing	(3002,0011)	2	Physical distance (in mm) between the center of each image pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing.	Determined from the imaging hardware parameters and license keys.
RT Image Position	(3002,0012)	2	The x and y coordinates (in mm) of the upper left hand corner (first pixel transmitted) of the	Determined from the imaging hardware

Attribute Name	Tag	Type	Attribute Description	Notes
			image, in the IEC X-RAY IMAGE RECEPTOR coordinate system.	parameters.
Radiation Machine Name	(3002,0020)	2	User-defined name identifying radiation machine used in acquiring or computing image (i.e. name of conventional simulator, electron accelerator, X-ray device, or machine modeled when calculating DRR).	Configured in Registry.
Primary Dosimeter Unit	(300A,00B3)	2	Measurement unit of machine dosimeter. Enumerated Values: MU = Monitor Unit MINUTE = minute	MU
Radiation Machine SAD	(3002,0022)	2	Radiation source to Gantry rotation axis distance of radiation machine used in acquiring or computing image (mm).	Configured in Registry; normally the value is 1000.
Radiation Machine SSD	(3002,0024)	3	Source to patient surface distance (in mm) of radiation machine used in acquiring or computing image.	SSD, if it is available.
RT Image SID	(3002,0026)	2	Distance from radiation machine source to image plane (in mm) along radiation beam axis.	SID
Source to Reference Object Distance	(3002,0028)	3	Source to reference object distance (in mm), as used for magnification calculation of RADIOGRAPH and SIMULATOR images.	Configured in Registry; Normally the value is 400.
Referenced RT Plan Sequence	(300C,0002)	3	Introduces sequence of one Class/Instance pair describing RT Plan associated with image. Only a single item shall be permitted in this sequence.	Not Used.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Not Used.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C, 0002) is sent.	Not Used.
Referenced Beam Number	(300C,0006)	3	Uniquely identifies the corresponding N segment treatment beam specified by Beam Number (300A, 00C0) within Beam Sequence in RT Beams Module within the RT Plan referenced in Referenced RT Plan Sequence (300C, 0002).	Not Used.
Referenced Fraction Group Number	(300C, 0022)	3	Identifier of Fraction Group within RT Plan referenced in Referenced RT Plan Sequence (300C, 0002).	Not Used.
Fraction Number	(3002,0029)	3	Fraction Number of fraction during which image was acquired, within Fraction Group referenced by Referenced Fraction Group Number (300C, 0022) within RT Plan referenced in Referenced RT Plan Sequence (300C,0002).	Not Used.
Start Cumulative Meterset Weight	(300C, 0008)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number (300C,0006) at which image acquisition starts.	Not Used.
End Cumulative Meterset Weight	(300C,0009)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number (300C,0006) at which image acquisition ends.	Not Used.
Exposure Sequence	(3002,0030)	3	Introduces sequence of Exposure parameter sets, corresponding to exposures used in generating the image. One or more items may be included in this sequence.	

Attribute Name	Tag	Type	Attribute Description	Notes
>Referenced Frame Number	(0008,1160)	1C	Identifies corresponding image frame in multi-frame image. Required if Exposure Sequence (3002,0030) is sent, there is more than one item in Exposure Sequence (3002,0030), and image is a multi-frame image.	Determined by internal counter in Image Acquisition.
>KVP	(0018,0060)	2C	Peak kilo voltage output (kV) of X-ray generator used to acquire image. Required if Value 3 of Image Type (0008,0008) is PORTAL, SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	EnergyMeV * 1000.0
>X-Ray Tube Current	(0018,1151)	2C	Imaging device X-ray Tube Current (mA). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Not Used.
>Exposure Time	(0018,1150)	2C	Time of X-ray exposure (msec). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Not Used.
>Meterset Exposure	(3002,0032)	2C	Treatment machine Meterset duration over which image has been acquired, specified in Monitor units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3). Required if Value 3 of Image Type (0008,0008) is PORTAL and Exposure Sequence (3002,0030) is sent.	Determined using MU.
>Diaphragm Position	(3002,0034)	3	Positions of diaphragm jaw pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis in the IEC order X1, X2, Y1, Y2.	Not Used.
>Beam Limiting Device Sequence	(300A,00B6)	3	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions for given exposure. One or more items may be included in this sequence.	Image Acquisition fills in 2 sequences, one for the X and another for the Y sequences.(?)
>>RT Beam Limiting Device Type	(300A,00B8)	1C	Type of beam limiting device (collimator). Required if Beam Limiting Device Sequence (300A,00B6) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction	Determined using bLDX for the first sequence, and then bLDY for the second sequence.
>>Source to Beam Limiting Device Distance	(300A,00BA)	3	Radiation source to beam limiting device (collimator) distance (mm).	Configured in Registry.
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1C	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws). Required if Beam Limiting Device Sequence (300A,00B6) is sent.	Determined using bLDXLeaves/2 for the first sequence, and then Y for the second sequence.
>>Leaf Position Boundaries	(300A,00BE)	2C	Boundaries (in mm) of beam limiting device (collimator) leaves (elements) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device	Determined from Registry for both sequences.

Attribute Name	Tag	Type	Attribute Description	Notes
			Type (300A,00B8), i.e. X-axis for MLCY, Yaxis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY.	
>>Leaf/Jaw Positions	(300A,011C)	1C	Positions of beam limiting device (collimator) leaf or jaw (element) pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g. X-axis for MLCX, Yaxis for MLCY). Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), in IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N. Required if Beam limiting Device Sequence (300A,00B6) is sent.	Determined using bLDXPositions and BLDYPositions for the first and second sequence respectively.
>Applicator Sequence	(300A,0107)	3	Introduces sequence of Applicators associated with Beam. Only a single item shall be permitted in this sequence.	Not Used.
>>Applicator ID	(300A,0108)	1C	User or machine supplied identifier for Applicator. Required if Applicator Sequence (300A,0107) is sent.	Not Used.
>>Applicator Type	(300A,0109)	1C	Type of Applicator. Required if Applicator Sequence (300A,0107) is sent. Defined Terms: ELECTRON_SQUARE = square electron applicator ELECTRON_RECT = rectangular electron applicator ELECTRON_CIRC = circular electron applicator ELECTRON_SHORT = short electron applicator ELECTRON_OPEN = open (dummy) electron applicator INTRAOPERATIVE = intraoperative (custom) applicator STEREOTACTIC = stereotactic applicator	Not Used.
>>Applicator Description	(300A,010A)	3	User-defined description for Applicator.	Not Used.
>Number of Blocks	(300A,00F0)	1C	Number of shielding blocks associated with Beam. Required if Exposure Sequence (3002,0030) is sent.	Not Used.
>Block Sequence	(300A,00F4)	2C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks (300A,00F0) is non-zero. One or more items may be included in this sequence.	Not Used.
>>Block Tray ID	(300A,00F5)	3	User-supplied identifier for block tray.	Not Used.
>>Source to Block Tray Distance	(300A,00F6)	2C	Radiation Source to attachment edge of block tray assembly (mm). Required if Block Sequence (300A,00F4) is sent.	Not Used.
>>Block Type	(300A,00F8)	1C	Type of block. Required if Block Sequence (300A,00F4) is sent. Enumerated Values: SHIELDING = blocking material is inside contour APERTURE = blocking material is outside contour	Not Used.

Attribute Name	Tag	Type	Attribute Description	Notes
>>Block Divergence	(300A,00FA)	2C	Indicates presence or otherwise of geometrical divergence. Required if Block Sequence (300A,00F4) is sent. Enumerated Values: PRESENT = block edges are shaped for beam divergence ABSENT = block edges are not shaped for beam divergence	Not Used.
>>Block Number	(300A,00FC)	1C	Identification Number of the Block. The value of Block Number (300A,00FC) shall be unique within the Beam in which it is created. Required if Block Sequence (300A,00F4) is sent.	Not Used.
>>Block Name	(300A,00FE)	3	User-defined name for block.	Not Used.
>>Material ID	(300A,00E1)	2C	User-supplied identifier for material used to manufacture Block. Required if Block Sequence (300A,00F4) is sent.	Not Used.
>>Block Thickness	(300A,0100)	3	Physical thickness of block (in mm) parallel to radiation beam axis.	Not Used.
>>Block Number of Points	(300A,0104)	2C	Number of (x,y) pairs defining the block edge. Required if Block Sequence (300A,00F4) is sent.	Not Used.
>>Block Data	(300A,0106)	2C	A data stream of (x,y) pairs which comprise the block edge. The number of pairs shall be equal to Block Number of Points (300A,0104), and the vertices shall be interpreted as a closed polygon. Coordinates are projected onto the machine isocentric plane in the IEC BEAM LIMITING DEVICE coordinate system (mm). Required if Block Sequence (300A,00F4) is sent.	Not Used.
Gantry Angle	(300A,011E)	3	Treatment machine gantry angle, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	GantryAngle
Beam Limiting Device Angle	(300A,0120)	3	Treatment machine beam limiting device (collimator) angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees).	CollimatorAngle
Patient Support Angle	(300A,0122)	3	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	CouchAngle
Table Top Eccentric Axis Distance	(300A,0124)	3	Distance (positive) from the IEC PATIENT SUPPORT vertical axis to the IEC TABLE TOP ECCENTRIC vertical axis (mm).	Configured in registry; Normally the value is 950
Table Top Eccentric Angle	(300A,0125)	3	Table Top (non-isocentric) angle, i.e. orientation of IEC TABLE TOP ECCENTRIC coordinate system with respect to IEC PATIENT SUPPORT system (degrees).	EccentricAngle
Table Top Vertical Position	(300A,0128)	3	Table Top Vertical position in IEC TABLE TOP coordinate system (mm).	Determined from CouchPosition
Table Top Longitudinal Position	(300A,0129)	3	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm).	Determined from CouchPosition
Table Top Lateral Position	(300A,012A)	3	Table Top Lateral position in IEC TABLE TOP coordinate system (mm).	Determined from CouchPosition

Note: RT Image Attributes supported by Image Acquisition. Bold-faced values are actual values, italicized values are given by Treatment Delivery subsystem, and underlined values are described in subsequent sections.

A.7.26.4 Cine Module

The cine module is stored only for a Multi Frame Image.

Cine Image Attributes supported by Image Acquisition only:

Attribute Name	Tag	Type	Attribute Description	Notes
Preferred Playback Sequencing	(0018,1244)	3	Describes the preferred playback sequencing for a multi-frame image. Enumerated Values: 0 = Looping (1,2...n,1,2,...n,1,2,....n,...) 1 = Sweeping (1,2,...n,n-1,...2,1,2,...n,...)	Not Used.
Frame Time	(0018,1063)	1C	Nominal time (in msec) per individual frame. Required if Frame Increment Pointer (0028,0009) points to Frame Time.	Not Used.
Frame Time Vector	(0018,1065)	1C	An array which contains the real time increments (in msec) between frames for a Multi-frame image. See C.7.6.5.1.2 for further explanation. Required if Frame Increment Pointer (0028,0009) points to Frame Time Vector.	Determined as offset, in ms, from the first acquired frame, which has the value 0.
Start Trim	(0008,2142)	3	The frame number of the first frame of the Multi-frame image to be displayed.	Not Used.
Stop Trim	(0008,2143)	3	The Frame Number of the last frame of a Multi-frame image to be displayed.	Not Used.
Recommended Display Frame Rate	(0008,2144)	3	Recommended rate at which the frames of a Multi-frame image should be displayed in frames/second.	Not Used.
Cine Rate	(0018,0040)	3	Number of frames per second.	kV/MV parameter
Frame Delay	(0018,1066)	3	Time (in msec) from Content Time (0008,0033) to the start of the first frame in a Multi-frame image.	Not Used.
Image Trigger Delay	(0018,1067)	3	Delay time in milliseconds from trigger (e.g., X-ray on pulse) to the first frame of a Multi-frame image.	Not Used.
Effective Duration	(0018,0072)	3	Total time in seconds that data was actually taken for the entire Multi-frame image.	kV/MV parameter
Actual Frame Duration	(0018,1242)	3	Elapsed time of data acquisition in msec per each frame.	kV/MV parameter.

A.7.26.5 SOP Common Module

The SOP Common module is mandatory for all DICOM objects. *syngo* fills the first two attributes, SOP Class UID and SOP Instance UID, automatically when the object is created in the database.

Attribute Name	Tag	Type	Attribute Description	Notes
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class.	Filled by *syngo*.
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance.	Filled by *syngo*.
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used.	For Study, Series and Image, filled based on character set of parent. For Patient, filled as configured in

Attribute Name	Tag	Type	Attribute Description	Notes
				registry.
Instance Creation Date	(0008,0012)	3	Date the SOP Instance was created.	Not used.
Instance Creation Time	(0008,0013)	3	Time the SOP Instance was created.	Not used.
Instance Creator UID	(0008,0014)	3	Uniquely identifies device, which created the SOP Instance.	Not used.
Timezone Offset From UTC	(0008,0201)	3	Contains the offset from UTC to the timezone for all DA and TM Attributes present in this SOP Instance. Encoded as an ASCII string in the format “&ZZZZ”. The components of this string, from left to right, are & = “+” or “-”, and ZZZZ = Hours and Minutes of offset. Time earlier than UTC is expressed as a negative offset. The local timezone offset is undefined if this Attribute is absent.	Not used
Instance Number	(0020,0013)	3	A number that identifies this Composite object instance.	Used by *syngo* RT Therapist
SOP Instance Status	(0100,0410)	3	A flag that indicates the storage status of the SOP Instance. Not Specified (NS) implies that this SOP Instance has no special storage status, and hence no special actions need be taken. Original (OR) implies that this is the primary SOP instance for the purpose of storage, but that it has not yet been authorized for diagnostic use. Authorized Original (AO) implies that this is the primary SOP instance for the purpose of storage, which has been authorized for diagnostic use. Any copies of an Authorized Original should be given the status of Authorized Copy. Authorized Copy (AC) implies that this is a copy of an Authorized Original SOP Instance. Enumerated Values: NS, OR, AO, AC	Not used
SOP Authorization Date and Time	(0100,0420)	3	The date and time when the SOP Instance Status (0100,0410) was set to AO.	Not used
SOP Authorization Comment	(0100,0424)	3	Any comments associated with the setting of the SOP Instance Status (0100,0410) to AO.	Not used
Authorization Equipment Certification Number	(0100,0426)	3	The certification number issued to the Application Entity that set the SOP Instance Status (0100,0410) to AO.	Not used

A.7.27 CT Image Attributes

A.7.27.1 CT Image Module

Attribute Name	Tag	Type	Attribute Description	Notes
Image Type	(0008, 0008)	1	Image identification characteristics.	AXIAL (added as the third image type after DERIVED and PRIMARY)
Samples per Pixel	(0028, 0002)	1	Number of samples (planes) in this image.	In *syngo*, stored in the Image Pixel module.
Photometric Interpretation	(0028, 0004)	1	Specifies the intended interpretation of the pixel data.	In *syngo*, stored in the Image Pixel module.
Bits Allocated	(0028, 0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated.	In *syngo*, stored in the Image Pixel module.
Bits Stored	(0028, 0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored.	In *syngo*, stored in the Image Pixel module.
High Bit	(0028, 0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.	In *syngo*, stored in the Image Pixel module.
Rescale Intercept	(0028, 1052)	1	The value b in relationship between stored values (SV) and Hounsfield (HU). HU = m*SV+b	**Error! Objects cannot be created from editing field codes.**
Rescale Slope	(0028, 1053)	1	m in the equation specified in Rescale Intercept (0028,1052).	**Error! Objects cannot be created from editing field codes.** where **Error! Objects cannot be created from editing field codes.** and **Error! Objects cannot be created from editing field codes.** are read from SiteHU calibration file.
KVP	(0018, 0060)	2	Peak kilo voltage output of the x-ray generator used	Filled from the Projection image.
Acquisition Number	(0020, 0012)	2	A number identifying the single continuous gathering of data over a period of time which resulted in this image	Not Used
Scan Options	(0018,0022)	3	Parameters of scanning sequence.	Not used.
Data Collection Diameter	(0018,0090)	3	The diameter in mm of the region over which data were collected	Fill up using maximum FOV
Reconstruction Diameter	(0018,1100)	3	Diameter in mm of the region from within which data were used in creating the	Fill up using current FOV. Currently current FOV = maximum FOV

Attribute Name	Tag	Type	Attribute Description	Notes
			reconstruction of the image. Data may exist outside this region and portions of the patient may exist outside this region.	
Distance Source to Detector	(0018,1110)	3	Distance in mm from source to detector center	Filled as the SID from the Projection image.
Distance Source to Patient	(0018,1111)	3	Distance in mm from source to isocenter (center of field of view)	Filled as the SAD from the Projection image.
Gantry/Detector Tilt	(0018,1120)	3	Nominal angle of tilt in degrees of the scanning gantry. Not intended for mathematical computations.	Not used.
Table Height	(0018,1130)	3	The distance in mm of the top of the patient table to the center of rotation; below the center is positive.	Not filled up.
Rotation Direction	(0018,1140)	3	Direction of rotation of the source when relevant, about nearest principal axis of equipment. Enumerated Values: CW = clockwise CC = counter clockwise	Filled with data from the MacroApplication.
Exposure Time	(0018,1150)	3	Time of x-ray exposure in msec	Not used.
X-ray Tube Current	(0018,1151)	3	X-ray Tube Current in mA.	Not used.
Exposure	(0018,1152)	3	The exposure expressed in mAs, for example calculated from Exposure Time and X-ray Tube Current.	Use only in case of KV – fill with total mAS . It will be obtained from projection image by summing mAS per frame.
Exposure in □As	(0018,1153)	3	The exposure expressed in µAs, for example calculated from Exposure Time and X-ray Tube Current.	Not used.
Filter Type	(0018,1160)	3	Label for the type of filter inserted into the x-ray beam.	Not used.
Generator Power	(0018,1170)	3	Power in kW to the x-ray generator.	Not used.
Focal Spot	(0018,1190)	3	Size of the focal spot in mm. For devices with variable focal spot or multiple focal spots, small dimension followed by large dimension.	Fill focal spot only if you get information from DMIP or somewhere else
Convolution Kernel	(0018,1210)	3	A label describing the convolution kernel or algorithm used to reconstruct the data	Filled with the name of the filter used in reconstruction.

A.7.28 SC Image Attributes

A.7.28.1 SC Image Module

Attribute Name	Tag	Type	Attribute Description
Date of Secondary Capture	(0018,1012)	3	The date the Secondary Capture Image was captured. Usage: Used by *syngo* RT Therapist
Time of Secondary Capture	(0018,1014)	3	The time the Secondary Capture Image was captured. Usage: Used by *syngo* RT Therapist
Nominal Scanned Pixel Spacing	(0018,2010)	3	Physical distance on the media being digitized or scanned between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See 10.7.1.3 for further explanation of the value order. Shall be consistent with Pixel Aspect Ratio (0028,0034), if present. Usage: Not used
Pixel Spacing	(0028,0030)	1C	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. See 10.7.1.1 and 10.7.1.3. Required if the image has been calibrated. May be present otherwise. Usage: Used by *syngo* RT Therapist
Pixel Spacing Calibration Type	(0028,0A02)	3	The type of correction for the effect of geometric magnification or calibration against an object of known size, if any. See 10.7.1.2. Usage: Not Used
Pixel Spacing Calibration Description	(0028,0A04)	1C	A free text description of the type of correction or calibration performed. **Notes:** 1. In the case of correction, the text might include description of the assumptions made about the body part and geometry and depth within the patient. 2. In the case of calibration, the text might include a description of the fiducial and where it is located (e.g., “XYZ device applied to the skin over the greater trochanter”). 3. Though it is not required, the Device Module may be used to describe the specific characteristics and size of the calibration device. Required if Pixel Spacing Calibration Type (0028,0A02) is present. Usage: Not Used

A.7.29 Networked Configuration Workflow Management

A.7.29.1 *syngo* RT Workflow

The *syngo* RT Workflow component serves as a single interface for *syngo* RT Therapist to an external OIS. It coordinates the workflow among the workspaces of the *syngo* Suite for Oncology and integrates with the patient schedule from the OIS using modality worklists (MWL). It also supports charge capture using DICOM modality performed procedure step (MPPS) events.

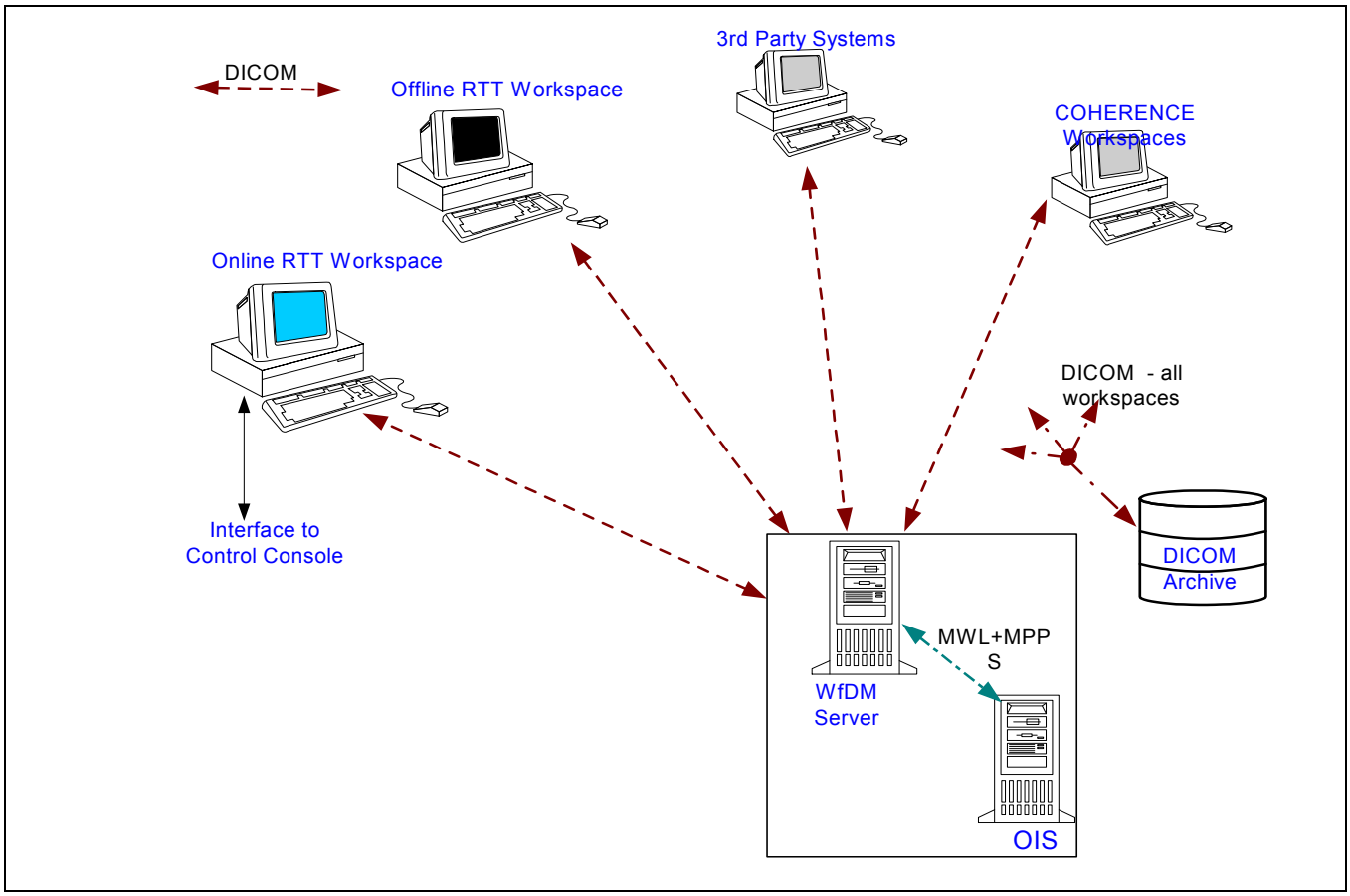


Figure 13: Schematic diagram of the deployment architecture of *syngo* RT Therapist in *syngo* RT Workflow scenario.

A.8 APPENDIX A

A.8.1 RT Image Private Attributes

RT Image private attributes set for portal images captured within *syngo* RT Therapist.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Beam ID	0x39	SIEMENS MED OCS FIELD ID	0x80	CS	1-n	Stores the Beam ID
Beam Name	0x39	SIEMENS MED OCS FIELD NAME	0x79	CS	1-n	Stores the Beam Name
Site Name	0x39	SIEMENS MED OCS SITE NAME	0x78	CS	1-n	Stores the Site Name
Number of Frames	0x39	SIEMENS MED OCS NUMBER OF FRAMES	0x76	IS	1-n	Stores the Number of Frames used to produce the composite frame
Number of Sub Frames	0x39	SIEMENS MED OCS NUMBER OF SUB FRAMES	0x77	IS	1-n	Stores the number of sub frames for each frame
Calibration Date of Gain Image	0x39	SIEMENS MED OCS CALIBRATION DATE	0x81	DT	1-n	Stores the date of the Gain Image used for correction.
Starting Gantry Angle	0x39	SIEMENS MED OCS CBT STARTING GANTRY ANGLE	0x82	DS	1-n	Stores the starting gantry position of a Cone Beam Acquisition.
Ending Gantry Angle	0x39	SIEMENS MED OCS CBT ENDING GANTRY ANGLE	0x83	DS	1-n	Stores the ending gantry position of a Cone Beam Acquisition.
Arc Increment	0x39	SIEMENS MED OCS CBT ARC INCREMENT	0x84	IS	1-n	Stores the arc increment of a Cone Beam Acquisition.
Gantry Rotation Direction	0x39	SIEMENS MED OCS CBT GANTRY ROTATION DIRECTION	0x85	CS	1-n	Stores the gantry rotation direction of a Cone Beam Acquisition.
Gantry Positions	0x39	SIEMENS MED OCS CBT PROJECTION GANTRY POSITIONS	0x86	DS	1-n	Stores the current gantry angle of each projection frame.
Reconstruction Slice Width	0x39	SIEMENS MED OCS CBT RECON SLICE WIDTH	0x87	IS	1	Stores the slice width of the reconstruction frame.
Reconstruction Slice Height	0x39	SIEMENS MED OCS CBT RECON SLICE HEIGHT	0x88	IS	1	Stores the slice height of the reconstruction frame.
Reconstruction Slice Thickness	0x39	SIEMENS MED OCS CBT RECON SLICES THICKNESS	0x89	DS	1	Stores the slice thickness of the reconstruction frame.
Reconstruction Filter Type	0x39	SIEMENS MED OCS CBT RECON FILTER TYPE	0x90	IS	1	Stores the filter type to be used during reconstruction.
Missing Projection Frames	0x39	SIEMENS MED OCS CBT MISSING PROJECTION FRAMES	0x91	IS	1-n	Stores the missing projection frame numbers.
Valid Dead Pixel Map Flag	0x39	SIEMENS MED OCS PI VALID PIXEL MAP	0x92	IS	1	Stores the valid dead pixel map flag (0 – invalid, 1-valid)
Patient Orientation	0x39	SIEMENS MED OCS CBT PATIENT ORIENTATION	0x93	CS	1	Stores the patient orientation during the Cone Beam Acquisition. In release 4.x and higher this attribute shall be extended to 2d images.
Alignment Offset Valid Flag	0x39	SIEMENS MED OCS PI ALIGNMENT IMAGE	0x94	IS	1	Stores the flag for valid alignment offset result (0 – invalid, 1 – valid)
Flat Panel Alignment last calibration Date and Time	0x39	SIEMENS MED OCS FP Alignment Calibration Date / Time	0x95	DT	1	Stores the date and time of Flat Panel last Calibration.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Total MU delivered during Cone Beam	0x39	SIEMENS MED OCS CBT TOTAL MU	0x96	DS	1	Stores the total MU delivered during the cone Beam Acquisition.
I0-MU Scale Factor	0x39	SIEMENS MED OCS CBT I0 MU SCALE FACTOR	0x97	IS	1	Stores the I0-MU scale factor on the Cone Beam Projection Image.
Gated Image Frames	0x39	SIEMENS MED OCS PI CINE IMAGE GATING	0x61	IS	1	Stores the gating triggering flag in case of Cine images
Dose Area Product	0x39	SIEMENS MED OCS DOSE AREA PRODUCT	0x60	DS	1	Stores the area dose product per exposure and total in cGy.cm²
Image panel type	0x39	SIEMENS MED OCS IMAGING PANEL TYPE	0x74	CS	1	Stores the image panel type. MV / KV
Radiation source type	0x39	SIEMENS MED OCS SOURCE TYPE	0x73	IS	1	Stores the radiation source type. 1 – MV 2 – KV
EFOV flag	0x39	SIEMENS MED OCS EXTENDED FOV	0x72	IS	1	Stores the extended field of view flag. 1 – EFOV 0 – Centered detector
Lateral offset of the panel	0x39	SIEMENS MED OCS LATERAL PANEL SHIFT	0x71	DS	1	Stores the Lateral offset of the panel in mm
Longitudinal offset of the panel	0x39	SIEMENS MED OCS LONGITUDINAL PANEL SHIFT	0x59	DS	1	Stores the longitudinal offset of the panel in mm.
Detector Gain	0x39	SIEMENS MED OCS CBT DETECTOR GAIN	0x70	IS	1	Stores the detector gain used during the cone Beam Acquisition.
Patient anatomy type	0x39	SIEMENS MED OCS CBT PATIENT ANATOMY TYPE	0x69	IS	1	Stores the patient anatomy type. Used for Cone Beam Projection images only. 1- Head Neck 2 - Thoracic 3 - Pelvis
Patient anatomy size	0x39	SIEMENS MED OCS CBT PATIENT ANATOMY SIZE	0x68	IS	1	Stores the patient anatomy size. Used for Cone Beam Projection images only. 1- Small 2 - Medium 3 - Large
Dose rate	0x39	SIEMENS MED OCS CBT DOSE RATE	0x67	DS	1	Stores the dose rate used during the cone Beam Acquisition.
Diffusion filter flag	0x39	SIEMENS MED OCS CBT DIFFUSION FILTER	0x66	IS	1	Stores the Diffusion filter flag (0 – not set, 1 – set)
Scatter correction flag	0x39	SIEMENS MED OCS CBT SCATTER CORRECTION	0x65	IS	1	Stores the Scatter correction flag (0 – not set, 1 – set)
Ring artifact correction flag	0x39	SIEMENS MED OCS CBT RING ARTIFACT CORRECTION	0x64	IS	1	Stores the Ring artifact correction flag (0 – not set, 1 – set)
Full scan flag	0x39	SIEMENS MED OCS CBT FULL SCAN	0x63	IS	1	Stores the Full scan flag (0 – not set, 1 – set)
HU calibration flag	0x39	SIEMENS MED OCS CBT HU CALIBRATION	0x62	IS	1	Stores the HU calibration flag (0 – not set, 1 – set)
Invalid Projection Frames	0x39	SIEMENS MED OCS CBT IMAGINGBUS REPORTED INVALID FRAMES	0x91	IS	1-n	Stores the Invalid projection frame numbers.
Software version	0x39	SIEMENS MED OCS PI SOFTWARE VERSION	0x57	CS	1	Stores the software version of the product.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Reference image UID	0x39	SIEMENS MED OCS REFERENCE IMAGE	0x76	CS	1	Store the referenced image UID
CBT Missing actuals	0x39	SIEMENS MED OCS CBT MISSING ACTUALS	0x50	IS	1-n	Store the projection frame number for which actuals is not received.
CBT start of Hardware Synchronization problem	0x39	SIEMENS MED OCS CBT FIRST INVALID PROJECTION FRAME	0x51	IS	1	Stores the frame number from which hardware synchronization problem between ImageBus and Flatpanel started.
Dead Pixel Type	0x39	SIEMENS MED OCS PI DEAD PIXEL MAP TYPE	0x49	CS	1	Specified whether the DPM is merged DPM. If not a Merged DPM, then capacitance in which DPM acquired will be stored. In R4.1, possible values are: 1. MERGED DPMBI 2. 1pF 3. 8pF
2D Image Type	0x39	SIEMENS MED OCS PI 2D IMAGE TYPES	0x55	CS	1-n	Stores the image type for Multiframe images. (see below table for values stored)
Acknowledgment Status	0x39	SIEMENS MED OCS ACKNOWLEDGE FLAG	0x81	IS	1	Stores the information on whether the user was notified about approval comment. 1 indicates that the user was notified 0 or attribute not present indicates that the user is yet to be notified.

A.8.2 RT Plan Private Attributes

syngo RT Therapist stores private attributes for the RT General Plan within a single private attribute in XML format.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
RT General Plan external attributes	0x37	SIEMENS MED OCS PUBLIC RT PLAN ATTRIBUTES	0x00	UT	1	Private attributes that shall be published to external systems for possible interpretation
RT General Plan Local attributes	0x37	SIEMENS MED OCS PRIVATE RT PLAN ATTRIBUTES	0x00	UT	1	Private attributes that are internal to *syngo* RT Therapist

A.8.2.1 RT General Plan External Private Attributes

Module	Private attribute	Interpretation
RT General Plan	Completed_Plan	This flag is used to tag the plan as completed. If this attribute is not present, the plan is assumed to be ON_TREATMENT. Defined Terms: COMPLETED ON_TREATMENT
	RT_Plan_Checksum	This field contains the CRC checksum for the RT Plan.
	Late Resumption Notification	The attribute defines if the user shall be notified about incomplete fractions upon patient load. The enumerated values are: LR_DO_NOT_NOTIFY LR_NOTIFY_USER
	RT_BEAMS_APPROVAL	This attribute defines that Therapists approved the beam parameters. This attribute is defined on plan level and only in plans imported to *syngo* RT Therapist workspace.
	RT_SITE_APPROVAL	This attribute defines that Oncologist approved the prescription.
	RT_QA_APPROVAL	Not used
	OIS_Plan	Not used
	OIS_Transferred	Not used
RT Prescription	RT_Prescription_Creation_Date_Time	DateTime stamp corresponding to the creation time of the RT Prescription
	Lead_Dose	Defines the point when the user will be notified about approaching warning dose alert.
	Delivery_Warning_Dose_Description	Description of action to be taken when Delivery Warning Dose level (300A,0022) is exceeded.
RT Patient Setup	RT_Patient_Setup_Creation_Date_Time	
	Patient_Setup_Name	User-defined name for the patient setup.
	Additional_Setup_Instructions	Used to store additional description of patient position if it exceeds DICOM specified 64 character limit.
	Referenced_Setup_Image_Sequence (In RT General Plan.)	Sequence of Setup images. (The Setup images sequence is used only in the RT General Plan module.)

Module	Private attribute	Interpretation
	>Referenced_SOP_Class_UID	Uniquely identifies the referenced SOP Class.
	>Referenced_SOP_Instance_UID	Uniquely identifies the referenced SOP Instance.
	> Setup_Image_Description	User defined description of the setup image.
RT Fraction Group	RT_Fraction_Group_Creation_Date_Time	DateTime stamp corresponding to the creation time of the RT Fraction Group
	Fraction_Group_Name	Name of Fraction Group (absent in DICOM)
	Fraction_Time_Interval	The minimum time between the deliveries of two fractions of this fraction group (hours.)
	Fractions_Per_Week	The number of fractions per week scheduled for treatment with this fraction group.
RT Beam	RT_Beam_Creation_Date_Time	DateTime stamp corresponding to the creation time of the RT Beam
	Beam_Setup_Instructions	Setup notes for this beam, if available.
	Treatment_Pause	When set, there is an automatic treatment pause inserted before treatment of this beam: 1 – Pause before the first verification image segment 2 – Pause before the first treatment segment 3 – Pause before both, the first verification image segment and treatment segment.
	Treatment_Pause_Comment	User-defined comment that describes the reason and action to be performed for that pause.
	Gated_Delivery	If set, this beam requires gated delivery.
	Bolus_Description	The description of the bolus for this beam. (Absent in DICOM.)
	Beam_Delta	The Beam delta used to expand a treatment port to an open port for this beam.
	Gantry_Table_Movement_Order	The order of movement of the gantry and table if required for this beam. – Undefined. – Gantry First. – Table First.
	Gantry_Direction_To_Next_Beam	Not used

Module	Private attribute	Interpretation
	Port_Only_Set	If this flag is set, then the beam is configured for port-only delivery.
	Is_Hidden_Beam	This flag is used to tag the beam as hidden. - '0' - the beam is not hidden - '1' - the beam is hidden If this attribute is not available, the beam is assumed to be not hidden.
	KV_Beam_Energy	Not Used
	KV_Beam_Exposure	Not Used
RT Tolerance Table	RT_Tolerance_Table_Creation_Date_Time	DateTime stamp corresponding to the creation time of the RT Tolerance Table
	SID_Tolerance	Tolerance value for Source-to-Imager distance for MV flat panel
	FlatPanel_LateralPos_Tolerance	Tolerance value for the lateral position of the MV flat panel
	FlatPanel_LongitudinalPos_Tolerance	Tolerance value for the longitudinal position of the MV flat panel
	KV_SID_Tolerance	Not used
	KV_FlatPanel_LateralPos_Tolerance	Not used

Note: All attributes in the above list are external private attributes. *syngo* RT Therapist does not have any internal private attributes at present. The additional private identification code for internal private attributes (viz. SIEMENS MED OCS PRIVATE RT PLAN ATTRIBUTES) was generated for future use.

A.8.2.2 RT General Plan External Private Attributes XML Schema

The xml schema below outlines the structure of the *syngo* RT Therapist private attributes stored in the RT General Plan module.

```
<xs:schema id="RT_General_Plan_private_attributes"
targetNamespace="http://www.siemens.com/med/ocs/DICOM/2007/10/18/RTGeneralPlanPrivateAttributes.xsd"
xmlns="http://www.siemens.com/med/ocs/DICOM/2007/10/18/RTGeneralPlanPrivateAttributes.xsd"
xmlns:mstns="http://www.siemens.com/med/ocs/DICOM/2007/10/18/RTGeneralPlanPrivateAttributes.xsd"
xmlns:xs="http://www.w3.org/2001/XMLSchema">
   <xs:simpleType name="Lead_Dose_Type">
      <xs:restriction base="xs:double">
         <xs:minInclusive value="0"/>
      </xs:restriction>
   </xs:simpleType>
   <xs:simpleType name="Fraction_Time_Interval_Type">
      <xs:restriction base="xs:double">
         <xs:minInclusive value="0"/>
      </xs:restriction>
   </xs:simpleType>
   <xs:simpleType name="Beam_Name_Type">
      <xs:restriction base="xs:string">
         <xs:length value="1"/>
      </xs:restriction>
   </xs:simpleType>
   <xs:complexType name="RT_Tolerance_Table_Shadow_Attribute_Schema">
      <xs:sequence>
         <xs:element name="RT_Tolerance_Table" maxOccurs="unbounded">
            <xs:complexType>
               <xs:all>
                  <xs:element name="RT_Tolerance_Table_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
                  <xs:element name="SID_Tolerance"                    type="xs:long" minOccurs="0" maxOccurs="1"/>
                  <xs:element name="FlatPanel_LateralPos_Tolerance"      type="xs:long" minOccurs="0" maxOccurs="1"/>
                  <xs:element name="FlatPanel_LongitudinalPos_Tolerance" type="xs:long" minOccurs="0"
maxOccurs="1"/>
                  <xs:element name="KV_SID_Tolerance"                 type="xs:long" minOccurs="0" maxOccurs="1"/>
                  <xs:element name="KV_FlatPanel_LateralPos_Tolerance"   type="xs:long" minOccurs="0"
maxOccurs="1"/>
               </xs:all>
               <xs:attribute name="Tolerance_Table_Number" type="xs:long"  use="required"/>
            </xs:complexType>
         </xs:element>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="RT_Prescription_Shadow_Attribute_Schema">
      <xs:sequence>
         <xs:element name="RT_Prescription" maxOccurs="unbounded">
            <xs:complexType>
               <xs:all>
                  <xs:element name="RT_Prescription_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
                  <xs:element name="Lead_Dose"                    type="Lead_Dose_Type" minOccurs="0"/>
                  <xs:element name="Delivery_Warning_Dose_Description" type="xs:string"      minOccurs="0"/>
               </xs:all>
               <xs:attribute name="Dose_Reference_Number" type="xs:long" use="required"/>
            </xs:complexType>
         </xs:element>
      </xs:sequence>
   </xs:complexType>
   <xs:complexType name="RT_Patient_Setup_Shadow_Attribute_Schema">
      <xs:sequence>
         <xs:element name="RT_Patient_Setup" maxOccurs="unbounded">
```

```
          <xs:complexType>
            <xs:sequence>
              <xs:element name="RT_Patient_Setup_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
              <xs:element name="Patient_Setup_Name" type="xs:string"/>
              <xs:element name="Additional_Setup_Instructions" type="xs:string"/>
              <xs:element name="Referenced_Setup_Image_Sequence" minOccurs="0">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="Setup_Image" minOccurs="1">
                      <xs:complexType>
                        <xs:sequence>
                          <xs:element name="Setup_Image_Description"     type="xs:string"/>
                          <xs:element name="Referenced_SOP_Class_UID"    type="xs:string"/>
                          <xs:element name="Referenced_SOP_Instance_UID" type="xs:string"/>
                        </xs:sequence>
                      </xs:complexType>
                    </xs:element>
                  </xs:sequence>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
            <xs:attribute name="Patient_Setup_Number" type="xs:long" use="required"/>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
    <xs:complexType name="RT_Fraction_Group_Shadow_Attribute_Schema">
      <xs:sequence>
        <xs:element name="RT_Fraction_Group" maxOccurs="unbounded">
          <xs:complexType>
            <xs:all>
              <xs:element name="RT_Fraction_Group_Creation_Date_Time" type="xs:string" minOccurs="0"
maxOccurs="1"/>
              <xs:element name="Fraction_Group_Name"    type="xs:string"/>
              <xs:element name="Fraction_Time_Interval" type="Fraction_Time_Interval_Type" minOccurs="0"/>
              <xs:element name="Fractions_Per_Week"     type="xs:long"/>
            </xs:all>
            <xs:attribute name="Fraction_Group_Number" type="xs:long" use="required"/>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
    <xs:complexType name="RT_Beam_Shadow_Attribute_Schema">
      <xs:sequence>
        <xs:element name="RT_Beam" maxOccurs="unbounded">
          <xs:complexType>
            <xs:all>
              <xs:element name="RT_Beam_Creation_Date_Time" type="xs:string" minOccurs="0" maxOccurs="1"/>
              <xs:element name="Bolus_Description" type="xs:string"  minOccurs="0"/>
              <xs:element name="Gated_Delivery" type="xs:boolean" minOccurs="0"/>
              <xs:element name="Treatment_Pause" type="xs:long" minOccurs="0"/>
              <xs:element name="Treatment_Pause_Comment" type="xs:string" minOccurs="0"/>
              <xs:element name="Gantry_Table_Movement_Order" type="xs:long" minOccurs="0"/>
              <xs:element name="Beam_Delta" type ="xs:long" minOccurs="0"/>
              <xs:element name="Gantry_Direction_To_Next_Beam" type="xs:long" minOccurs="0"/>
              <xs:element name="Port_Only_Set" type="xs:boolean" minOccurs="0"/>
              <xs:element name="Is_Hidden_Beam" type="xs:boolean" minOccurs="0"/>
              <xs:element name="KV_Beam_Energy" type="xs:double" minOccurs="0"/>
              <xs:element name="KV_Beam_Exposure" type="xs:double" minOccurs="0"/>
              <xs:element name="Beam_Setup_Instructions" type="xs:string"  minOccurs="0"/>
            </xs:all>
            <xs:attribute name="Beam_Name" type="Beam_Name_Type"  use="required"/>
```

```
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
  <xs:complexType name="RT_Approval_Shadow_Attribute_Schema">
    <xs:all>
      <xs:element name="APPROVAL_STATUS"       type="xs:string" minOccurs="0"/>
      <xs:element name="APPROVAL_REVIEWER_NAME" type="xs:string" minOccurs="0"/>
      <xs:element name="APPROVAL_REVIEW_DATE"   type="xs:string" minOccurs="0"/>
      <xs:element name="APPROVAL_REVIEW_TIME"   type="xs:string" minOccurs="0"/>
    </xs:all>
  </xs:complexType>
  <xs:complexType name = "RT_Plan_Type">
    <xs:sequence>
      <xs:element name="RT_Tolerance_Table_Sequence"
            type="RT_Tolerance_Table_Shadow_Attribute_Schema"
            minOccurs="0">
        <xs:key name="Tolerance_Table_ID">
          <xs:selector xpath=".//Tolerance_Table"/>
          <xs:field xpath="@Tolerance_Table_Number"/>
        </xs:key>
      </xs:element>
      <xs:element name="RT_Prescription_Sequence"
            type="RT_Prescription_Shadow_Attribute_Schema"
            minOccurs="0">
        <xs:key name="Dose_Reference_ID">
          <xs:selector xpath=".//Dose_Reference"/>
          <xs:field xpath="@Dose_Reference_Number"/>
        </xs:key>
      </xs:element>
      <xs:element name="RT_Patient_Setup_Sequence"
            type="RT_Patient_Setup_Shadow_Attribute_Schema"
            minOccurs="0">
        <xs:key name="Patient_Setup_ID">
          <xs:selector xpath=".//Patient_Setup"/>
          <xs:field xpath="@Patient_Setup_Number"/>
        </xs:key>
      </xs:element>
      <xs:element name="RT_Fraction_Group_Sequence"
            type="RT_Fraction_Group_Shadow_Attribute_Schema"
            minOccurs="0">
        <xs:key name="Fraction_Group_ID">
          <xs:selector xpath=".//Fraction_Group"/>
          <xs:field xpath="@Fraction_Group_Number"/>
        </xs:key>
      </xs:element>
      <xs:element name="RT_Beam_Sequence"
            type="RT_Beam_Shadow_Attribute_Schema"
            minOccurs="0">
        <xs:key name="Beam_ID">
          <xs:selector xpath=".//RT_Beam"/>
          <xs:field xpath="@Beam_Name"/>
        </xs:key>
      </xs:element>
      <xs:element name="RT_BEAMS_APPROVAL" type="RT_Approval_Shadow_Attribute_Schema" minOccurs="0"/>
      <xs:element name="RT_SITE_APPROVAL"  type="RT_Approval_Shadow_Attribute_Schema" minOccurs="0"/>
      <xs:element name="RT_QA_APPROVAL"    type="RT_Approval_Shadow_Attribute_Schema" minOccurs="0"/>
      <xs:element name="RT_Plan_Checksum" type="xs:string"  minOccurs="0"/>
      <xs:element name="Completed_Plan"   type="xs:boolean" minOccurs="0"/>
      <xs:element name="OIS_Plan"         type="xs:boolean" minOccurs="0"/>
      <xs:element name="OIS_Transferred"  type="xs:boolean" minOccurs="0"/>
      <xs:element name="RT_Plan_Late_Resumption_Notification" type="xs:string" default="LR_NOTIFY_USER"
minOccurs="0"/>
```

```
      <xs:element name="RT_Plan_Rx_Description" type="xs:string" minOccurs="0"/>
    </xs:sequence>
    <xs:attribute name="Plan_UID" type="xs:string" use="required"/>
  </xs:complexType>
  <xs:element name="RT_Plan" type = "RT_Plan_Type"/>
</xs:schema>
```

A.8.3 RT Beams Treatment Record Private Attributes

syngo RT Therapist stores private attributes for the RTBeams Treatment Record module within a single private attribute in XML format.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
RT Beams Treatment Record External Attributes	0x37	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x00	UT	1	Beams Treatment Record Private attributes that shall be published to external systems for possible interpretation

A.8.3.1 RT Beams Treatment Record External Private Attributes

Module	Private attribute	Interpretation
RT Beams Session Record	Treatment_Notes	Notes entered by the user at the end of a fraction's treatment. The notes have the referenced fraction number as an attribute. Please refer to Note for a sample treatment notes.
	QA_Record	This boolean attribute identifies a QA record.
	MANUAL_RECORD_OIS	This boolean attribute identifies a manual record from OIS

Note: A sample treatment notes format is mentioned below

```
 <RT_Beam_Session_Record>
  <Treatment_Notes_Collection Referenced_Fraction_Number_3008_0223="4">
  <Treatment_Note Note Number = 1>
        <DateTime> 03. Apr 2007 1:37 PM </DateTime>
        <Note> Sample TxNotes  </Note >
  </Treatment_Note>
<Treatment_Note Note Number = 2>
        <DateTime> 03. Apr 2007 1:37 PM </DateTime>
        <Note> Sample TxNotes  </Note >
  </Treatment_Note>
</Treatment_Notes_Collection>
  <Treatment_Notes_Collection Referenced_Fraction_Number_3008_0223="5">
  <Treatment_Note Note Number = 1>
        <DateTime> 03. Apr 2007 1:37 PM </DateTime>
        <Note> Sample TxNotes  </Note >
  </Treatment_Note>
</RT_Beam_Session_Record>
```

A.8.3.2 RT Beams Treatment Record Private Attributes XML Schema

The xml schema below outlines the structure of the *syngo* RT Therapist private attributes stored in the RT Beams Treatment Record module.

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema id="syngo RT TherapistxBeamSessionReport"
targetNamespace="http://www.siemens.com/med/ocs/DICOM/2007/10/18/RTBeamsTxRecord.xsd"
xmlns="http://www.siemens.com/med/ocs/DICOM/2007/10/18/ RTBeamsTxRecord.xsd"
xmlns:mstns="http://www.siemens.com/med/ocs/DICOM/2007/10/18/ RTBeamsTxRecord.xsd"
xmlns:xs="http://www.w3.org/2001/XMLSchema">

 <xs:complexType name="RT_Summary_FractionGroup_Data">
  <xs:sequence>
   <xs:element name="Fraction_Group_Summary_Sequence_3008_0220" minOccurs="1">
    <xs:complexType>
     <xs:sequence>
      <xs:element name="Fraction_Status_Summary_Sequence_3008_0240" maxOccurs="unbounded">
       <xs:complexType>
        <xs:all>
         <xs:element name="Fraction_Termination_Status_3008_002A" type="xs:string" minOccurs="1"
maxOccurs="1"/>
        </xs:all>
        <xs:attribute name="Referenced_Fraction_Number_3008_0223" type="xs:positiveInteger" use="required"/>
       </xs:complexType>
       <xs:key name="Referenced_Fraction_Number_3008_0223">
        <xs:selector xpath=".//Referenced_Fraction_Number_3008_0223"/>
        <xs:field xpath="@Referenced_Fraction_Number_3008_0223"/>
       </xs:key>
      </xs:element>
     </xs:sequence>
     <xs:attribute name="Referenced_Fraction_Group_Number_300C_0022" type="xs:positiveInteger" use="required"/>
    </xs:complexType>
    <xs:key name="Referenced_Fraction_Group_Number_300C_0022">
     <xs:selector xpath=".//Referenced_Fraction_Group_Number_300C_0022"/>
     <xs:field xpath="@Referenced_Fraction_Group_Number_300C_0022"/>
    </xs:key>
   </xs:element>
  </xs:sequence>
 </xs:complexType>

 <xs:complexType name = "RT_Beam_Session_Record_Type">
  <xs:sequence>
   <xs:element name="RT_Summary_Record_Attributes" type="RT_Summary_FractionGroup_Data" minOccurs="0"/>
   <xs:element name="QA_Record" type="xs:boolean" minOccurs="0"/>
   <xs:element name="MANUAL_RECORD_OIS" type="xs:boolean" minOccurs="0"/>
   <xs:element name=" Treatment_Notes_Collection" minOccurs="0">
    <xs:complexType>
     <xs:simpleContent>
      <xs:extension base="xs:string">
      <xs:attribute name="Referenced_Fraction_Number_3008_0223" type="xs:positiveInteger" use="required"/>
      <xs:attribute name="Setup_Index_Number" type="xs:positiveInteger" use="required"/>
      </xs:extension>
     </xs:simpleContent>
    </xs:complexType>
   </xs:element>
  </xs:sequence>
 </xs:complexType>

 <xs:element name="RT_Beam_Session_Record" type = "RT_Beam_Session_Record_Type"/>

</xs:schema>
```

A.8.4 RT Patient Setup Module Shadow Attributes

syngo RT Therapist stores the positioning offsets applied during treatment in the RT Patient Setup module of the RT Beams Treatment Record IOD. These values are stored in shadow attributes at the RT Patient Setup module level.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Position verification Lateral offset	0x300B	SIEMENS_MED_OCS_*syngo* RT Therapist_*SYNGO*_PATIENT_SETUP_RECORD ATTRIBUTES	0x52	DS	1	Positioning offset applied during treatment
Position verification Longitudinal offset	0x300B	SIEMENS_MED_OCS_*syngo* RT Therapist_*SYNGO*_PATIENT_SETUP_RECORD ATTRIBUTES	0x53	DS	1	Positioning offset applied during treatment
Position verification Vertical offset	0x300B	SIEMENS_MED_OCS_*syngo* RT Therapist_*SYNGO*_PATIENT_SETUP_RECORD ATTRIBUTES	0x54	DS	1	Positioning offset applied during treatment

A.8.5 Treatment Session Beam Sequence Shadow Attributes

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
In Session Resumption UID	0x39	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x55	DS	1	This attribute contains a double number that is the value of the ColeDateTime value of the first delivery of the beam that was treated in this session and is being resumed. All related deliveries of a beam in a session (i.e. the first partial delivery and all subsequent resumptions of this beam in this session.) will be marked with this shadow attribute. This attribute is used to identify all related resumption deliveries of a beam in a session.
KV Specified Beam Exposure	0x39	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x56	DS	1	This attributes contains the planned beam exposure for this beam in mA. Used for only delivery of KV beams.
KV Delivered Beam Exposure	0x39	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x57	DS	1	This attributes contains the delivered beam exposure for this beam in mA.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
						Used for only delivery of KV beams.
KV Delivered Beam Energy	0x39	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x58	DS	1	This attributes contains the delivered beam energy for this beam in kV. Used for delivery of KV beams only.
PI Beam Uniformity	0x39	SIEMENS MED OCS PI BEAM UNIFORMITY	0x58	CS	1	
Delivered Port Only	0x39	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x60	DS	1	This attribute specifies if the beam was delivered as a “Port-Only” beam.
Node Imaging Connection	0x39	SIEMENS MED OCS BEAMS_SESSION_RECORD ATTRIBUTES	0x61	DS	1	This attribute contains a double number that is the value of the ColeDateTime value of the delivery of first segment of the beam. *syngo* RT Therapist stores the imaging segments delivery and the treatment segments delivery in separate Treatment Session Beam Sequences. These two are identified as records of the same beam delivery using the node imaging connection attribute.

A.8.6 RT Structure Set Private Attributes

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Treatment Plan UID	0x39	Tx_RTPLAN_INFO	0x08	UI	1	Stores the UID of the treatment Plan.
Precedessor UID	0x39	SIEMENS MED OCS SS VERSION INFO	0x76	UI	1	Stores the UID of the previous version of the Structure Set
ROI Visiblity	0x39	SIEMENS MED OCS SS DISPLAY INFO	0x78	ST	1	Saved in triplets of ROI name, ROI number and visibility.

A.8.7 Imaging Calibration

Imaging Calibration is deployed on *syngo* RT Therapist Workspaces as standalone application and if license is available. It provides following functionality:

- Means to create Dead Pixel Maps to be used by Image Acquisition.
- Means to perform Cone Beam Geometry Calibration.
- Means to perform Flat Panel Alignment Calibration.
- Means to perform MV alignment procedure (when applicable).

A.8.7.1 RT Image IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used
Series	RT Series	M Usage: Used
Frame of Reference	Frame of Reference	U Usage: Not used
Equipment	General Equipment	M Usage: Not Used
Image	General Image	M Usage: Used
	Image Pixel	M Usage: Used
	Contrast/Bolus	C-Required if contrast media was used in this image. Usage: Not used
	Cine	M Usage: Not Used
	Multi-Frame	C - Required if pixel data multiframe data. Usage: Used
	RT Image	M Usage: Used
	Modality LUT	U Usage: Not used
	VOI LUT	U Usage: Not used
	Approval	U Usage: Not Used
	Curve	U Usage: Not used
	Audio	U Usage: Not used
	SOP Common	M Usage: Used

A.8.7.2 CT Image IOD Modules

IE	Module	Usage
Patient	Patient	M Usage: Used
Study	General Study	M Usage: Used
	Patient Study	U Usage: Not used

IE	Module	Usage
Series	General Series	M Usage: Used
Frame of Reference	Frame of Reference	U Usage: Not used
Equipment	General Equipment	U Usage: Not used
Image	General Image	M Usage: Used
	Image Plane	M Usage: Used
	Image Pixel	M Usage: Used
	Contrast/Bolus	C Usage: Not used
	CT Image	M Usage: Used
	Overlay Plane	U Usage: Not used
	VOI LUT	U Usage: Not used
	SOP Common	M Usage: Used

A.8.7.3 Patient Module

Attribute Name	Tag	Type	Attribute Description	Notes
Patient's Name	(0010,0010)	2	Patient's full name.	Read by Calib QA
Patient ID	(0010,0020)	2	Primary hospital identification number or code for the patient.	Not Used
Patient's Birth Date	(0010,0030)	2	Birth date of the patient.	Not Used
Patient's Sex	(0010,0040)	2	Sex of the named patient. Enumerated Values: M = male F = female O = other	Not Used
Patient Comments	(0010,4000)	3	User-defined additional information about the patient.	Not Used
Referenced Patient Sequence	(0008,1120)	3	A sequence which provides reference to a Patient SOP Class/Instance pair. Only a single Item shall be permitted in this Sequence.	Not used
Patient's Birth Time	(0010,0032)	3	Birth time of the Patient.	Not used
Other Patient IDs	(0010,1000)	3	Other identification numbers or codes used to identify the patient.	Not used
Other Patient Names	(0010,1001)	3	Other names used to identify the patient.	Not used
Ethnic Group	(0010,2160)	3	Ethnic group or race of the patient.	Not used
Patient Address	(0010,1040)	3	Legal address of the named patient.	Not used
Patient's Telephone Number	(0010,2154)	3	Telephone numbers at which the patient can be reached.	Not used

A.8.7.4 General Study Module

Attribute Name	Tag	Type	Attribute Description	Notes
Study Instance UID	(0020,000D)	1	Unique identifier for the Study.	Not Used
Study Date	(0008,0020)	2	Date the Study started.	Not used
Study Time	(0008,0030)	2	Time the Study started.	Not used
Referring Physician's Name	(0008,0090)	2	Patient's referring physician	Not used
Study ID	(0020,0010)	2	User or equipment generated Study identifier.	Not used
Accession Number	(0008,0050)	2	A RIS generated number which identifies the order for the Study.	Not used
Study Description	(0008,1030)	3	Institution-generated description or classification of the Study (component) performed.	Not used
Physician(s) of Record	(0008,1048)	3	Physician(s) who are responsible for overall patient care at time of Study (see Section C.7.3.1 for Performing Physician)	Not used
Name of Physician(s) Reading Study	(0008,1060)	3	Physician(s) reading the Study.	Not used
Referenced Study Sequence	(0008,1110)	3	A sequence which provides reference to a Study SOP Class/Instance pair. The sequence may have zero or more Items.	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Study Sequence (0008,1110) is sent.	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Study Sequence (0008,1110) is sent.	Not used
Procedure Code Sequence	(0008,1032)	3	A Sequence that conveys the type of procedure performed. One or more Items may be included in this Sequence.	Not used

A.8.7.5 General Series Module

Attribute Name	Tag	Type	Attribute Description	Notes
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series.	Read by Calib QA
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.	Not used
Series Number	(0020,0011)	2	A number that identifies this Series.	Not used
Laterality	(0020,0060)	2C	Laterality of (paired) body part examined. Required if the body part examined is a paired structure and Image Laterality (0020,0062) is not sent. Enumerated Values: R = right	Not used

Attribute Name	Tag	Type	Attribute Description	Notes
			L = left Note: Some IODs support Image Laterality (0020,0062) at the Image level, which can provide a more comprehensive mechanism for specifying the laterality of the body part(s) being examined.	
Series Date	(0008,0021)	3	Date the Series started.	Read by Calib QA
Series Time	(0008,0031)	3	Time the Series started.	Read by Calib QA
Performing Physician's Name	(0008,1050)	3	Name of the physicians administering the Series.	Not used
Protocol Name	(0018,1030)	3	User-defined description of the conditions under which the Series was performed. Note: This attribute conveys series specific protocol identification and may or may not be identical to the one presented in the Performed Protocol Code Sequence (0040,0260).	Not used
Series Description	(0008,103E)	3	User provided description of the Series.	Read by Calib QA
Operators' Name	(0008,1070)	3	Technologist(s) supporting the Series.	Not used
Reference Study Component Sequence	(0008,1111)	3	Uniquely identifies the Study Component SOP Instance or Modality Performed Procedure Step SOP Instance to which the Series is related. The Sequence shall have zero or one Item.	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Study Component Sequence (0008,1111) is sent.	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced Study Component Sequence (0008,1111) is sent.	Not used
Body Part Examined	(0018,0015)	3	Text description of the part of the body examined. Defined Terms: SKULL, CSPINE, TSPINE, LSPINE, SSPINE, COCCYX, CHEST, CLAVICLE, BREAST, ABDOMEN, PELVIS, HIP, SHOULDER, ELBOW, KNEE, ANKLE, HAND, FOOT, EXTREMITY, HEAD, HEART, NECK, LEG, ARM, JAW	Not used
Patient Position	(0018,5100)	2C	Patient position descriptor relative to the equipment. Required for CT and MR images.	Not used

Attribute Name	Tag	Type	Attribute Description	Notes
Smallest Pixel Value in Series	(0028,0108)	3	The minimum value of all images in this Series.	Not used
Largest Pixel Value in Series	(0028,0109)	3	The maximum value of all images in this Series.	Not used
Request Attributes Sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items.	Not used
>Requested Procedure ID	(0040,1001)	1C	Identifier which identifies the Requested Procedure in the Imaging Service Request. Required if Sequence Item is present.	Not used
>Requested Procedure Step ID	(0040,0009)	1C	Identifier which identifies the Scheduled Procedure Step. Required if Sequence Item is present.	Not used
>Scheduled Procedure Step Description	(0040,0007)	3	Institution-generated description or classification of the Scheduled Procedure Step to be performed.	Not used
>Scheduled Action Item Code Sequence	(0040,008)	3	Sequence describing the Scheduled Protocol following a specific coding scheme. This sequence contains one or more Items.	Not used
Performed Procedure Step ID	(0040,0253)	3	Identification of that part of a Procedure that has been carried out within this step.	Not used
Performed Procedure Step Start Date	(0040,0244)	3	Date on which the Performed Procedure Step started.	Not used
Performed Procedure Step Start Time	(0040,0245)	3	Time on which the Performed Procedure Step started.	Not used
Performed Procedure Step Description	(0040,0254)	3	Institution-generated description or classification of the Procedure Step that was performed.	Not used
Performed Action Item Sequence	(0040,0260)	3	Sequence describing the Protocol performed for this Procedure Step. One or more Items may be included in this Sequence.	Not used

A.8.7.6 General Image Module

Attribute Name	Tag	Type	Attribute Description	Notes
Instance Number	(0020,0013)	2	A number that identifies this image.	Read/Write by Calib QA
Patient Orientation	(0020,0020)	2C	Patient direction of the rows and columns of the image. Required if image does not require Image Orientation (Patient) (0020,0037) and Image Position (Patient) (0020,0032).	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
Content Date	(0008,0023)	2C	The date the image pixel data creation started. Required if image is part of a series in which the images are temporally related. Note: This Attribute was formerly known as Image Date.	Not Used
Content Time	(0008,0033)	2C	The time the image pixel data creation started. Required if image is part of a series in which the images are temporally related.	Not Used
Image Type	(0008,0008)	3	Image identification characteristics.	ORIGINAL/ DERIVED, PRIMARY/ SECONDARY, PORTAL, ORIGINALBINARY/ UPDATEDBINARY
Acquisition Number	(0020,0012)	3	A number identifying the single continuous gathering of data over a period of time, which resulted in this image.	Not Used
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started	Not Used
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started	Not Used
Acquisition Datetime	(0008,002A)	3	The date and time that the acquisition of data that resulted in this image started. Note: The synchronization of this time with an external clock is specified in the Synchronization Module in Acquisition Time Synchronized (0018,1800).	Not Used
Referenced Image Sequence	(0008,1140)	3	A sequence which provides reference to a set of Image SOP Class/Instance identifying other images significantly related to this image (e.g. post-localizer CT image or Mammographic biopsy or partial view images)	Not used
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced Image Sequence (0008,1140) is sent.	Not used
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Reference Image Sequence (0008,1140) is sent.	Not used
>Referenced Frame Number	(0008,1160)	3	References one or more image frames of a Multi-frame Image SOP Instance, identifying which frames are significantly related to this image.	Not used
Derivation Description	(0008,2111)	3	A text description of how this image was derived.	Not Used
Source Image Sequence	(0008,2112)	3	A Sequence, which identifies the set of Image SOP Class/Instance pairs of the Images, which were used to derive this Image. Zero or more Items may be included in this Sequence.	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Source Image Sequence (0008,2112) is sent.	Not Used
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Source Image Sequence (0008,2112) is sent.	Not Used
>Referenced Frame Number	(0008,1160)	3	References one or more image frames of a Multi-frame Image SOP Instance, identifying which frames were used to derive this image.	Not Used
Images in Acquisition	(0020,1002)	3	Number of images that resulted from this acquisition of data	Not used
Image Comments	(0020,4000)	3	User-defined comments about the image	Read/Write by Calib QA
Quality Control Image	(0028,0300)	3	Indicates whether or not this image is a quality control or phantom image. Enumerated Values: YES NO If this Attribute is absent, then the image may or may not be a quality control or phantom image.	Not Used
Burned In Annotation	(0028,0301)	3	Indicates whether or not image contains sufficient burned in annotation to identify the patient and date the image was acquired. Enumerated Values: YES NO If this Attribute is absent, then the image may or may not contain burned in annotation.	Not Used
Lossy Image Compression	(0028,2110)	3	Specifies whether an Image has undergone lossy compression. Enumerated Values: 00 = Image has NOT been subjected to lossy compression. 01 = Image has been subjected to lossy compression.	Not Used
Lossy Image Compression Ratio	(0028,2112)	3	Describes the approximate lossy compression ratio(s) that have been applied to this image. May be multivalued if successive lossy compression steps have been applied. Notes: 1. For example, a compression ratio of 30:1 would be described in this Attribute with a single value of 30. 2. For historical reasons, the lossy compression ratio should also be described in Derivation Description (0008,2111).	Not used
Icon Image Sequence	(0088,0200)	3	This icon image is representative of the Image.	Not used
> Image Pixel Module				See Image Pixel section

Attribute Name	Tag	Type	Attribute Description	Notes
Presentation LUT Shape	(2050,0020)	3	When present, specifies an identity transformation for the Presentation LUT such that the outputs of all grayscale transformations, if any, are defined to be in P-Values.	Not used

A.8.7.7 RT Image Module

Attribute Name	Tag	Type	Attribute Description	Notes
Samples per Pixel	(0028, 0002)	1	Number of samples (planes) in this image.	Read by Calib QA
Photometric Interpretation	(0028, 0004)	1	Specifies the intended interpretation of the pixel data.	Not Used
Bits Allocated	(0028, 0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated.	Read by Calib QA
Bits Stored	(0028, 0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored.	Read by Calib QA
High Bit	(0028, 0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.	Not Used
Pixel Representation	(0028, 0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated values: 0000H = unsigned integer 0001H = 2's complement	Not Used
RT Image Label	(3002,0002)	1	User-defined label for RT Image.	Read/Write by Calib QA
RT Image Name	(3002,0003)	3	User-defined name for RT Image.	Not Used
RT Image Description	(3002,0004)	3	User-defined description of RT Image.	Not Used
Operators' Name	(0008,1070)	2	Name of operator(s) acquiring or creating RT Image.	Not Used
Image Type	(0008,0008)	1	Image identification characteristics (see Section C.7.6.1.1.2). RT Images shall use one of the following Defined Terms for Value 3: DRR = digitally reconstructed radiograph PORTAL = digital portal image or portal film image SIMULATOR = conventional simulator image RADIOGRAPH = radiographic image BLANK = image pixels set to background value	Not Used
Conversion Type	(0008,0064)	2	Describes the kind of image conversion. Defined Terms: DV = Digitized Video DI = Digital Interface	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
			DF = Digitized Film WSD = Workstation	
Reported Values Origin	(3002,000A)	2C	Describes the origin of the parameter values reported in the image. Required if Value 3 of Image Type (0008,0008) is SIMULATOR or PORTAL. Enumerated Values: OPERATOR = manually entered by operator PLAN = planned parameter values ACTUAL = electronically recorded	Not Used
RT Image Plane	(3002,000C)	1	Describes whether or not image plane is normal to beam axis. Enumerated Values: NORMAL = image plane normal to beam axis NON_NORMAL = image plane non-normal to beam axis	Not Used
X-Ray Image Receptor Translation	(3002,000D)	3	Position in (x,y,z) coordinates of origin of IEC X-RAY IMAGE RECEPTOR System in the IEC GANTRY coordinate system (mm).	Read by Calib QA
X-Ray Image Receptor Angle	(3002,000E)	2	X-Ray Image Receptor Angle i.e. orientation of IEC X-RAY IMAGE RECEPTOR coordinate system with respect to IEC GANTRY coordinate system (degrees).	Read by Calib QA.
RT Image Orientation	(3002,0010)	2C	The direction cosines of the first row and the first column with respect to the IEC X-RAY IMAGE RECEPTOR coordinate system. Required if RT Image Plane (3002,000C) is NON_NORMAL.	Not Used
Image Plane Pixel Spacing	(3002,0011)	2	Physical distance (in mm) between the center of each image pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing.	Read in Calib QA
RT Image Position	(3002,0012)	2	The x and y coordinates (in mm) of the upper left hand corner (first pixel transmitted) of the image, in the IEC X-RAY IMAGE RECEPTOR coordinate system.	Not Used
Radiation Machine Name	(3002,0020)	2	User-defined name identifying radiation machine used in acquiring or computing image (i.e. name of conventional simulator, electron accelerator, X-ray device, or machine modeled when calculating DRR).	Not Used
Primary Dosimeter Unit	(300A,00B3)	2	Measurement unit of machine dosimeter. Enumerated Values: MU = Monitor Unit MINUTE = minute	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
Radiation Machine SAD	(3002,0022)	2	Radiation source to Gantry rotation axis distance of radiation machine used in acquiring or computing image (mm).	Read by Calib QA
Radiation Machine SSD	(3002,0024)	3	Source to patient surface distance (in mm) of radiation machine used in acquiring or computing image.	Not Used
RT Image SID	(3002,0026)	2	Distance from radiation machine source to image plane (in mm) along radiation beam axis.	Read in Calib QA
Source to Reference Object Distance	(3002,0028)	3	Source to reference object distance (in mm), as used for magnification calculation of RADIOGRAPH and SIMULATOR images.	Not Used
Referenced RT Plan Sequence	(300C,0002)	3	Introduces sequence of one Class/Instance pair describing RT Plan associated with image. Only a single item shall be permitted in this sequence.	Not Used
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class. Required if Referenced RT Plan Sequence (300C,0002) is sent.	Not Used
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance. Required if Referenced RT Plan Sequence (300C, 0002) is sent.	Not Used
Referenced Beam Number	(300C,0006)	3	Uniquely identifies the corresponding N segment treatment beam specified by Beam Number (300A, 00C0) within Beam Sequence in RT Beams Module within the RT Plan referenced in Referenced RT Plan Sequence (300C, 0002).	Not Used
Referenced Fraction Group Number	(300C, 0022)	3	Identifier of Fraction Group within RT Plan referenced in Referenced RT Plan Sequence (300C, 0002).	Not Used
Fraction Number	(3002,0029)	3	Fraction Number of fraction during which image was acquired, within Fraction Group referenced by Referenced Fraction Group Number (300C, 0022) within RT Plan referenced in Referenced RT Plan Sequence (300C,0002).	Not Used
Start Cumulative Meterset Weight	(300C, 0008)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number (300C,0006) at which image acquisition starts.	Not Used
End Cumulative Meterset Weight	(300C,0009)	3	Cumulative Meterset Weight within Beam referenced by Referenced Beam Number (300C,0006) at which image acquisition ends.	Not Used
Exposure Sequence	(3002,0030)	3	Introduces sequence of Exposure parameter sets, corresponding to exposures used	Read by Calib QA

Attribute Name	Tag	Type	Attribute Description	Notes
			in generating the image. One or more items may be included in this sequence.	
>Referenced Frame Number	(0008,1160)	1C	Identifies corresponding image frame in multi-frame image. Required if Exposure Sequence (3002,0030) is sent, there is more than one item in Exposure Sequence (3002,0030), and image is a multi-frame image.	Not Used
>KVP	(0018,0060)	2C	Peak kilo voltage output (kV) of X-ray generator used to acquire image. Required if Value 3 of Image Type (0008,0008) is PORTAL, SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Read by Calib QA
>X-Ray Tube Current	(0018,1151)	2C	Imaging device X-ray Tube Current (mA). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Not Used
>Exposure Time	(0018,1150)	2C	Time of X-ray exposure (msec). Required if Value 3 of Image Type (0008,0008) is SIMULATOR or RADIOGRAPH and Exposure Sequence (3002,0030) is sent.	Not Used
>Meterset Exposure	(3002,0032)	2C	Treatment machine Meterset duration over which image has been acquired, specified in Monitor units (MU) or minutes as defined by Primary Dosimeter Unit (300A,00B3). Required if Value 3 of Image Type (0008,0008) is PORTAL and Exposure Sequence (3002,0030) is sent.	Not Used
>Diaphragm Position	(3002,0034)	3	Positions of diaphragm jaw pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis in the IEC order X1, X2, Y1, Y2.	Not Used
>Beam Limiting Device Sequence	(300A,00B6)	3	Introduces sequence of beam limiting device (collimator) jaw or leaf (element) positions for given exposure. One or more items may be included in this sequence.	Read by Calib QA
>>RT Beam Limiting Device Type	(300A,00B8)	1C	Type of beam limiting device (collimator). Required if Beam Limiting Device Sequence (300A,00B6) is sent. Enumerated Values: X = symmetric jaw pair in IEC X direction Y = symmetric jaw pair in IEC Y direction ASYMX = asymmetric jaw pair in IEC X direction ASYMY = asymmetric pair in IEC Y direction	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
			MLCX = multileaf (multi-element) jaw pair in IEC X direction MLCY = multileaf (multi-element) jaw pair in IEC Y direction	
>>Source to Beam Limiting Device Distance	(300A,00BA)	3	Radiation source to beam limiting device (collimator) distance (mm).	Not Used
>>Number of Leaf/Jaw Pairs	(300A,00BC)	1C	Number of leaf (element) or jaw pairs (equal to 1 for standard beam limiting device jaws). Required if Beam Limiting Device Sequence (300A,00B6) is sent.	Not Used
>>Leaf Position Boundaries	(300A,00BE)	2C	Boundaries (in mm) of beam limiting device (collimator) leaves (elements) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), i.e. X-axis for MLCY, Y-axis for MLCX. Contains N+1 values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), starting from Leaf (Element) Pair 1. Required if RT Beam Limiting Device Type (300A,00B8) is MLCX or MLCY.	Not Used
>>Leaf/Jaw Positions	(300A,011C)	1C	Positions of beam limiting device (collimator) leaf or jaw (element) pairs (in mm) in IEC BEAM LIMITING DEVICE coordinate axis appropriate to RT Beam Limiting Device Type (300A,00B8), e.g. X-axis for MLCX, Yaxis for MLCY). Contains 2N values, where N is the Number of Leaf/Jaw Pairs (300A,00BC), in IEC leaf (element) subscript order 101, 102, ... 1N, 201, 202, ... 2N. Required if Beam limiting Device Sequence (300A,00B6) is sent.	Read by Calib QA
>Applicator Sequence	(300A,0107)	3	Introduces sequence of Applicators associated with Beam. Only a single item shall be permitted in this sequence.	Not Used
>>Applicator ID	(300A,0108)	1C	User or machine supplied identifier for Applicator. Required if Applicator Sequence (300A,0107) is sent.	Not Used
>>Applicator Type	(300A,0109)	1C	Type of Applicator. Required if Applicator Sequence (300A,0107) is sent. Defined Terms: ELECTRON_SQUARE = square electron applicator ELECTRON_RECT = rectangular electron applicator ELECTRON_CIRC = circular electron applicator ELECTRON_SHORT = short electron applicator ELECTRON_OPEN = open	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
			(dummy) electron applicator INTRAOPERATIVE = intraoperative (custom) applicator STEREOTACTIC = stereotactic applicator	
>>Applicator Description	(300A,010A)	3	User-defined description for Applicator.	Not Used
>Number of Blocks	(300A,00F0)	1C	Number of shielding blocks associated with Beam. Required if Exposure Sequence (3002,0030) is sent.	Not Used
>Block Sequence	(300A,00F4)	2C	Introduces sequence of blocks associated with Beam. Required if Number of Blocks (300A,00F0) is non-zero. One or more items may be included in this sequence.	Not Used
>>Block Tray ID	(300A,00F5)	3	User-supplied identifier for block tray.	Not Used
>>Source to Block Tray Distance	(300A,00F6)	2C	Radiation Source to attachment edge of block tray assembly (mm). Required if Block Sequence (300A,00F4) is sent.	Not Used
>>Block Type	(300A,00F8)	1C	Type of block. Required if Block Sequence (300A,00F4) is sent. Enumerated Values: SHIELDING = blocking material is inside contour APERTURE = blocking material is outside contour	Not Used
>>Block Divergence	(300A,00FA)	2C	Indicates presence or otherwise of geometrical divergence. Required if Block Sequence (300A,00F4) is sent. Enumerated Values: PRESENT = block edges are shaped for beam divergence ABSENT = block edges are not shaped for beam divergence	Not Used
>>Block Number	(300A,00FC)	1C	Identification Number of the Block. The value of Block Number (300A,00FC) shall be unique within the Beam in which it is created. Required if Block Sequence (300A,00F4) is sent.	Not Used
>>Block Name	(300A,00FE)	3	User-defined name for block.	Not Used
>>Material ID	(300A,00E1)	2C	User-supplied identifier for material used to manufacture Block. Required if Block Sequence (300A,00F4) is sent.	Not Used
>>Block Thickness	(300A,0100)	3	Physical thickness of block (in mm) parallel to radiation beam axis.	Not Used
>>Block Number of Points	(300A,0104)	2C	Number of (x,y) pairs defining the block edge. Required if Block Sequence (300A,00F4) is sent.	Not Used
>>Block Data	(300A,0106)	2C	A data stream of (x,y) pairs which comprise the block edge. The number of pairs shall be equal to Block Number of Points	Not Used

Attribute Name	Tag	Type	Attribute Description	Notes
			(300A,0104), and the vertices shall be interpreted as a closed polygon. Coordinates are projected onto the machine isocentric plane in the IEC BEAM LIMITING DEVICE coordinate system (mm). Required if Block Sequence (300A,00F4) is sent.	
Gantry Angle	(300A,011E)	3	Treatment machine gantry angle, i.e. orientation of IEC GANTRY coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Read by Calib QA
Beam Limiting Device Angle	(300A,0120)	3	Treatment machine beam limiting device (collimator) angle, i.e. orientation of IEC BEAM LIMITING DEVICE coordinate system with respect to IEC GANTRY coordinate system (degrees).	Not Used
Patient Support Angle	(300A,0122)	3	Patient Support angle, i.e. orientation of IEC PATIENT SUPPORT coordinate system with respect to IEC FIXED REFERENCE coordinate system (degrees).	Not Used
Table Top Eccentric Axis Distance	(300A,0124)	3	Distance (positive) from the IEC PATIENT SUPPORT vertical axis to the IEC TABLE TOP ECCENTRIC vertical axis (mm).	Not Used
Table Top Eccentric Angle	(300A,0125)	3	Table Top (non-isocentric) angle, i.e. orientation of IEC TABLE TOP ECCENTRIC coordinate system with respect to IEC PATIENT SUPPORT system (degrees).	Not Used
Table Top Vertical Position	(300A,0128)	3	Table Top Vertical position in IEC TABLE TOP coordinate system (mm).	Not Used
Table Top Longitudinal Position	(300A,0129)	3	Table Top Longitudinal position in IEC TABLE TOP coordinate system (mm).	Not Used
Table Top Lateral Position	(300A,012A)	3	Table Top Lateral position in IEC TABLE TOP coordinate system (mm).	Not Used

A.8.7.8 RT Image Private Attributes

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Dead pixel map type	0x39	SIEMENS MED OCS PI DEAD PIXEL MAP TYPE	0x49	CS	1	Stores the dead pixel map type
Rotational offset	0x39	SIEMENS MED OCS PI ROTATIONAL OFFSET	0x52	DS	1	Stores the rotational offset.
Longitudinal offset	0x39	SIEMENS MED OCS PI LONGITUDINAL OFFSET	0x53	DS	1	Stores the longitudinal offset.
Lateral offset	0x39	SIEMENS MED OCS PI LATERAL OFFSET	0x54	DS	1	Stores the lateral offset.
Software Version	0x39	SIEMENS MED OCS PI SOFTWARE VERSION	0x57	CS	1	Stores the software version.

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Longitudinal offset of the panel	0x39	SIEMENS MED OCS LONGITUDINAL PANEL SHIFT	0x59	DS	1	Stores the longitudinal offset of the panel in mm.
Dose Area Product	0x39	SIEMENS MED OCS DOSE AREA PRODUCT	0x60	DS	1	Stores the area dose product per exposure and total in cGy.cm²
Lateral offset of the panel	0x39	SIEMENS MED OCS LATERAL PANEL SHIFT	0x71	DS	1	Stores the lateral offset of the panel in mm.
EFOV flag	0x39	SIEMENS MED OCS EXTENDED FOV	0x72	IS	1	Stores the extended field of view flag. 1 – EFOV 0 – Centered detector
Radiation source type	0x39	SIEMENS MED OCS SOURCE TYPE	0x73	IS	1	Stores the radiation source type. 1 – MV 2 – KV
Image panel type	0x39	SIEMENS MED OCS IMAGING PANEL TYPE	0x74	CS	1	Stores the image panel type. MV / KV
Site Name	0x39	SIEMENS MED OCS SITE NAME	0x78	CS	1-n	Stores the Site Name
Beam Name	0x39	SIEMENS MED OCS FIELD NAME	0x79	CS	1-n	Stores the Beam Name
Beam ID	0x39	SIEMENS MED OCS FIELD ID	0x80	CS	1-n	Stores the Beam ID
Calibration Date of Gain Image	0x39	SIEMENS MED OCS CALIBRATION DATE	0x81	CS	1-n	Stores the date of the Gain Image used for correction.
Starting Gantry Angle	0x39	SIEMENS MED OCS CBT STARTING GANTRY ANGLE	0x82	DS	1-n	Stores the starting gantry position of a Cone Beam Acquisition.
Ending Gantry Angle	0x39	SIEMENS MED OCS CBT ENDING GANTRY ANGLE	0x83	DS	1-n	Stores the ending gantry position of a Cone Beam Acquisition.
Arc Increment	0x39	SIEMENS MED OCS CBT ARC INCREMENT	0x84	IS	1-n	Stores the arc increment of a Cone Beam Acquisition.
Gantry Rotation Direction	0x39	SIEMENS MED OCS CBT GANTRY ROTATION DIRECTION	0x85	CS	1-n	Stores the gantry rotation direction of a Cone Beam Acquisition.
Gantry Positions	0x39	SIEMENS MED OCS CBT PROJECTION GANTRY POSITIONS	0x86	DS	1-n	Stores the current gantry angle of each projection frame.
Valid Dead Pixel Map Flag	0x39	SIEMENS MED OCS PI VALID PIXEL MAP	0x92	IS	1	Stores the valid dead pixel map flag (0 – invalid, 1- valid)
Alignment Offset Valid Flag	0x39	SIEMENS MED OCS PI ALIGNMENT IMAGE	0x94	IS	1	Stores the flag for valid alignment offset result (0 – invalid, 1 – valid)
Flat Panel Alignment last calibration Date and Time	0x39	SIEMENS MED OCS FP Alignment Calibration Date / Time	0x95	DT	1	Stores the date and time of Flat Panel last Calibration.

A.8.7.9 CT Image Module

Attribute Name	Tag	Type	Attribute Description	Notes
Image Type	(0008,0008)	1	Image identification characteristics.	Not Used
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image.	Not used
Photometric Interpretation	(0028,0004)	1	Specifies the intended interpretation of the pixel data.	Not used
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated.	Not used
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored.	Not used
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.	Not used
Rescale Intercept	(0028,1052)	1	The value b in relationship between stored values (SV) and Hounsfield (HU). HU = m*SV+b	Read by Calib QA
Rescale Slope	(0028,1053)	1	m in the equation specified in Rescale Intercept (0028,1052).	Read by Calib QA
KVP	(0018,0060)	2	Peak kilo voltage output of the x-ray generator used.	Read by Calib QA
Acquisition Number	(0020,0012)	2	A number identifying the single continuous gathering of data over a period of time which resulted in this image.	Not used
Scan Options	(0018,0022)	3	Parameters of scanning sequence.	Not used
Data Collection Diameter	(0018,0090)	3	The diameter in mm of the region over which data were collected.	Not used
Reconstruction Diameter	(0018,1100)	3	Diameter in mm of the region from within which data were used in creating the reconstruction of the image. Data may exist outside this region and portions of the patient may exist outside this region.	Not used
Distance Source to Detector	(0018,1110)	3	Distance in mm from source to detector center.	Not used
Distance Source to Patient	(0018,1111)	3	Distance in mm from source to isocenter (center of field of view).	Not used
Gantry/Detector Tilt	(0018,1120)	3	Nominal angle of tilt in degrees of the scanning gantry. Not intended for mathematical computations.	Not used
Table Height	(0018,1130)	3	The distance in mm of the top of the patient table to the center of rotation; below the center is positive.	Not used

Attribute Name	Tag	Type	Attribute Description	Notes
Rotation Direction	(0018,1140)	3	Direction of rotation of the source when relevant, about nearest principal axis of equipment. Enumerated Values: CW = clockwise CC = counter clockwise	Not used
Exposure Time	(0018,1150)	3	Time of x-ray exposure in msec.	Not used
X-ray Tube Current	(0018,1151)	3	X-ray Tube Current in mA.	Not used
Exposure	(0018,1152)	3	The exposure expressed in mA, for example calculated from Exposure Time and X-ray Tube Current.	Not used
Exposure µAs	(0018,1153)	3	The exposure expressed in µA, for example calculated from Exposure Time and X-ray Tube Current.	Not used
Filter Type	(0018,1160)	3	Label for the type of filter inserted into the x-ray beam.	Not used
Generator Power	(0018,1170)	3	Power in kW to the x-ray generator.	Not used
Focal Spot	(0018,1190)	3	Size of the focal spot in mm. For devices with variable focal spot or multiple focal spots, small dimension followed by large dimension.	Not used
Convolution Kernel	(0018,1210)	3	A label describing the convolution kernel or algorithm used to reconstruct the data	Not used

A.8.7.10 Image Pixel Module

Attribute Name	Tag	Type	Attribute Description	Notes
Samples per Pixel	(0028, 0002)	1	Number of samples (planes) in this image.	Read by Calib QA
Photometric Interpretation	(0028, 0004)	1	Specifies the intended interpretation of the pixel data.	Not used
Rows	(0028, 0010)	1	Number of rows in the image.	Read by Calib QA
Columns	(0028, 0011)	1	Number of columns in the image.	Read by Calib QA
Bits Allocated	(0028, 0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated.	Read by Calib QA
Bits Stored	(0028, 0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored.	Read by Calib QA
High Bit	(0028, 0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit.	Not used
Pixel Representation	(0028, 0103)	1	Data representation of the pixel samples. Each sample shall have the same pixel representation. Enumerated values:	Not used

Attribute Name	Tag	Type	Attribute Description	Notes
			0000H = unsigned integer 0001H = 2's complement	
Pixel Data	(7FE0, 0010)	1	A data stream of the pixel samples that comprise the Image.	Read/Write by Calib QA
Planar Configuration	(0028, 0006)	1C	Indicates whether the pixel data are sent color-by-plane or color-by-pixel. Required if Samples per Pixel (0028,0002) has a value greater than 1.	Not used
Pixel Aspect Ratio	(0028, 0034)	1C	Ratio of the vertical size and horizontal size of the pixels in the image specified by a pair of integer values where the first value is the vertical pixel size, and the second value is the horizontal pixel size. Required if the aspect ratio is not 1\1 and the Image Plane Module is not applicable to this Image.	Not used
Smallest Image Pixel Value	(0028, 0106)	3	The minimum actual pixel value encountered in this image.	Not used
Largest Image Pixel Value	(0028, 0107)	3	The maximum actual pixel value encountered in this image.	Not used
Some Palette attributes only required if Photometric Interpretation is PALETTE_COLOR	(0028, 1101) (0028, 1102) (0028, 1103) (0028, 1201) (0028, 1202) (0028, 1203)	3	Specifies color palette look up tables.	Not used

A.8.7.11 Image Plane Module

Attribute Name	Tag	Type	Attribute Description	Notes
Pixel Spacing	(0028,0030)	1	Physical distance in the patient between the centers of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm.	Read by Calib QA.
Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient.	Not used.
Image Position (Patient)	(0020,0032)	1	The x, y, and z coordinates of the upper left hand corner (center of the first voxel transmitted) of the image, in mm	Not used.
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.	Read by Calib QA.
Slice Location	(0020,1041)	3	Relative position of exposure expressed in mm.	Not used.

A.8.7.12 SOP Common Module

Attribute Name	Tag	Type	Attribute Description	Notes
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class.	Filled by *syngo*.
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance.	Filled by *syngo*.
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used.	Not used.
Instance Creation Date	(0008,0012)	3	Date the SOP Instance was created.	Not used.
Instance Creation Time	(0008,0013)	3	Time the SOP Instance was created.	Not used.
Instance Creator UID	(0008,0014)	3	Uniquely identifies device, which created the SOP Instance.	Not used.

A.9 CDC

A.9.1 The Data Conditioner (CDC) as Service Class Provider (SCP)

Attributes read from PATIENT IDENTIFICATION Module

Attribute Name	Tag	Type	Notes
Patient's Name	(0010,0010)	2	Optional
Patient ID	(0010,0020)	2	Optional

Attributes read from PATIENT DEMOGRAPHIC Module

Attribute Name	Tag	Type	Notes
Patient's Birth Date	(0010,0030)		Optional
Patient's Address	(0010,1040)		Optional
Patient's Sex	(0010,0040)		Enumerated Values: M = male F = female O = other Optional
Patient's Telephone Numbers	(0010,2154)		Optional
Patient Comments	(0010,4000)		Optional

Attributes read from GENERAL STUDY Module

Attribute Name	Tag	Type	Notes
Study Instance UID	(0020,000D)	1	Required
Referring Physician's Name	(0008,0090)	2	Optional

Attributes read from GENERAL SERIES Module

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	Required RTIMAGE RTPLAN
Series Instance UID	(0020,000E)	1	Required
Series Description	(0008,103E)	3	Optional

Attributes read from RT SERIES Module

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	Required CR SC RTIMAGE RTPLAN
Series Instance UID	(0020,000E)	1	Required
Series Description	(0008,103E)	3	Optional

Attributes read from RT GENERAL PLAN Module

Attribute Name	Tag	Type	Notes
RT Plan Label	(300A,0002)	1	Optional (Required for CDC 1.1)

Attributes read from RT BEAMS Module

Attribute Name	Tag	Type	Notes
Beam Sequence	(300A,00B0)	1	Required
>Beam Number	(300A,00C0)	1	Required
>Beam Name	(300A,00C2)	3	Optional
>Treatment Machine Name	(300A,00B2)	2	Optional
>Control Point Sequence	(300A,0111)	1	First item is read if provided.

Attribute Name	Tag	Type	Notes
>>Gantry Angle	(300A,011E)	1C	Required
>>Beam Limiting Device Angle	(300A,0120)	1C	Required
>>Patient Support Angle	(300A,0122)	1C	Required
>>Table Top Eccentric Angle	(300A,0125)	1C	Required
>>Table Top Lateral Position	(300A,012A)	2C	Optional
>>Table Top Longitudinal Position	(300A,0129)	2C	Optional
>>Table Top Vertical Position	(300A,0128)	2C	Optional

Attributes read from GENERAL IMAGE Module

Attribute Name	Tag	Type	Notes
Image Type	(0008,0008)	3	Optional
Acquisition Date	(0008,0022)	3	Optional
Acquisition Time	(0008,0032)	3	Optional
Image Comments	(0020,4000)	3	Optional

Attributes read from IMAGE PLANE Module

Attribute Name	Tag	Type	Notes
Pixel Spacing	(0028,0030)	1	Optional
Image Orientation (Patient)	(0020,0037)	1	Optional

Attributes read from IMAGE PIXEL Module

Attribute Name	Tag	Type	Notes
Samples per Pixel	(0028,0002)	1	Required, only “1” supported
Photometric Interpretation	(0028,0004)	1	Required, only “MONOCHROME2” supported
Rows	(0028,0010)	1	Required, must be more or equal to zero
Columns	(0028,0011)	1	Required, must be more or equal to zero
Bits Allocated	(0028,0100)	1	Required, “8”, “12”, and “16” supported
Bits Stored	(0028,0101)	1	Required, should be less or equal to Bits Allocated
High Bit	(0028,0102)	1	Required, must be one less than Bits Stored
Pixel Representation	(0028,0103)	1	Required, only “0000H” supported
Pixel Data	(7FE0,0010)	1	Required. All pixel data is converted to short int representation of “MONOCHROME_2” type.

Attributes read from SC IMAGE Module

None

Attributes read from CR IMAGE Module

Attribute Name	Tag	Type	Notes
Imager Pixel Spacing	(0018,1164)	3	Optional

Attributes read from RT Image Module

Attribute Name	Tag	Type	Notes
Image Plane Pixel Spacing	(3002,0011)	2	Required
RT Image Label	(3002,0002)	1	Optional
Referenced Beam Number	(300C,0006)	3	Optional
Gantry Angle	(300A,011E)	3	Optional
RT Image SID	(3002,0026)	2	Optional
RT Image Position	(3002,0012)	2	Optional
X-Ray Image Receptor Translation	(3002,000D)	3	Optional

Attribute Name	Tag	Type	Notes
RT Image Plane	(3002,000C)	1	Required
RT Image Orientation	(3002,0010)	2C	Optional
Beam Limiting Device Angle	(300A,0120)	3	Optional
Patient Support Angle	(300A,0122)	3	Optional
Table Top Eccentric Angle	(300A,0125)	3	Optional
Table Top Lateral Position	(300A,012A)	3	Optional
Table Top Longitudinal Position	(300A,0129)	3	Optional
Table Top Vertical Position	(300A,0128)	3	Optional

Private Attributes in General Image Module

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Site Name	0x39	SIEMENS MED OCS SITE NAME	0x78	CS	1	Part of the RT Image; this attribute contains the plan label corresponding to the plan referred by the image
Field Name	0x39	SIEMENS MED OCS FIELD NAME	0x79	CS	1	Part of the RT Image; this attribute contains the beam name referred by the image

A.9.2 The Data Conditioner (CDC) as Service Class User (SCU)

Attributes written to GENERAL SERIES Module

Attribute Name	Tag	Type	Notes
Modality	(0008,0060)	1	Required RTIMAGE
Series Instance UID	(0020,000E)	1	Required
Series Description	(0008,103E)	3	Required

Attributes written to GENERAL IMAGE Module

Attribute Name	Tag	Type	Notes
Instance Number	(0020,0013)	2	Supported
Content Date	(0008,0023)	2C	Supported
Content Time	(0008,0033)	2C	Supported
Image Type	(0008,0008)	3	Supported
Acquisition Date	(0008,0022)	3	Supported
Acquisition Time	(0008,0032)	3	Supported
Image Comments	(0020,4000)	3	Supported

Attributes written to IMAGE PLANE Module

Attribute Name	Tag	Type	Notes
Pixel Spacing	(0028,0030)	1	Required
Image Orientation (Patient)	(0020,0037)	1	Required

Attributes written to IMAGE PIXEL Module

Attribute Name	Tag	Type	Notes
Samples per Pixel	(0028,0002)	1	Required, only “1” supported
Photometric Interpretation	(0028,0004)	1	Required, only “MONOCHROME2” supported
Rows	(0028,0010)	1	Required, must be more or equal to zero
Columns	(0028,0011)	1	Required, must be more or equal to zero
Bits Allocated	(0028,0100)	1	Required, “12”, and “16” supported
Bits Stored	(0028,0101)	1	Required, should be less or equal to Bits

Attribute Name	Tag	Type	Notes
			Allocated
High Bit	(0028,0102)	1	Required, must be one less than Bits Stored
Pixel Representation	(0028,0103)	1	Required, only “0000H” supported
Pixel Data	(7FE0,0010)	1	Required. “MONOCHROME_2”

Attributes written to RT Image Module

Attribute Name	Tag	Type	Notes
RT Image Label	(3002,0002)	1	Required
RT Image SID	(3002,0026)	2	Required
Radiation Machine SAD	(3002,0022)	2	Required
Radiation Machine Name	(3002,0020)	2	Required
RT Image Position	(3002,0012)	2	Required
X-Ray Image Receptor Translation	(3002,000D)	3	Required
RT Image Orientation	(3002,0010)	2C	Required
Image Plane Pixel Spacing	(3002,0011)	2	Required
Referenced RT Plan Sequence	(300C,0002)	3	Required
Referenced Beam Number	(300C,0006)	3	Required if beam is selected
Gantry Angle	(300A,011E)	3	Required if beam is selected
Beam Limiting Device Angle	(300A,0120)	3	Required if beam is selected
Patient Support Angle	(300A,0122)	3	Required if beam is selected
Table Top Eccentric Angle	(300A,0125)	3	Required if beam is selected
Table Top Lateral Position	(300A,012A)	3	Optional
Table Top Longitudinal Position	(300A,0129)	3	Optional
Table Top Vertical Position	(300A,0128)	3	Optional

Private Attributes in General Image Module

Private Attribute Name	Group	Private Owner Code	Element	VR	VM	Reason for use
Site Name	0x39	SIEMENS MED OCS SITE NAME	0x78	CS	1	Part of the RT Image; this attribute contains the plan label corresponding to the plan referred by the image
Field Name	0x39	SIEMENS MED OCS FIELD NAME	0x79	CS	1	Part of the RT Image; this attribute contains the beam name referred by the image